



# Productivity

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Focus : Business Process Re-engineering

Restructuring and Re-engineering in India

BPR & Supply Chain Management

Re-engineering A Not-for-Profit Organisation

BPR Through ERP & EWIS

Long Range Planning for Indian Coal Industry

Downsizing Vs Contract Labour System

Returns to Higher Education

Economics of Waste Collection & Recycling

Labour Market Adjustments Through Migration

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# Restructuring & Re-engineering in India: Choice or Compulsion

S.A. Khader and K. Suryanarayanan

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*As the world economy moves towards a borderless market, efforts to restructure and re-engineer are also on the rise in India, even in the governmental departments and undertakings. While some of the efforts are deliberately orchestrated, there is enough reason to believe that the market compulsions are forcing the Indian industries to have a re-look at the way they do their business. After an overview of the ongoing economic restructuring and liberalisation in India, the paper presents a bird's eye view of the on-going restructuring and re-engineering efforts in Indian industry. While taking note of the fact that many re-engineering efforts in the West have failed, the paper highlights that culture specific issues are critical to the success of these re-orientation exercises. The paper concludes by stressing the need for re-engineering and restructuring to complement each other in order to bring about the desired dramatic improvements on a sustained basis.*

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## Introduction

Restructuring and Re-engineering the two most chanted management Mantras today are ushering in a new kind of a managerial revolution during this decade by bringing managerial freedom in devising suitable innovative processes and the climate ultimately to result in customer delight through dramatic improvements in the free market. At this stage we should not forget to recall and compare with the first managerial revolution that took place during the first quarter of this century when the managerial power shifted from owner/capitalist (inheritors) to so called professional managers who ushered in the concepts of divisionalisation/specialisation and control as cardinal principles of scientific management. The current technological revolution particularly in the age of "Information Technology" has further boosted the "Managerial Freedom" to all levels of employees by enabling easy access to the data/information of enterprise and the market for decision making purposes.

## Restructuring & Re-engineering: An overview

Both Restructuring and Re-engineering lead to radical transformation. Restructuring focuses on transforming the business as a whole with the objective of bringing better customer focus, enhanced competitiveness, quicker response and greater clarity of structure, rules and accountability. On the other hand, Business Process Re-engineering (BPR) tries to bring in fundamental changes in the key business processes preferably starting from the scratch (on a clean slate) to accomplish dramatic improvements. The key issues associated with BPR are:

- Having a relook at the business right from the scratch
- Organising business along the process, setting aside traditional departmental barriers

- Intense and innovative use of modern information technology (IT)
- Strengthened focus on customers.

Several authors and professionals have developed their own models of restructuring and re-engineering, based on different perspectives. In this paper, restructuring is conceived to be a transformation of the organisational structure, policies etc., while by re-engineering is meant radical changes in the ways or processes in which business is carried out.

### Restructuring

Restructuring is relatively an older concept used extensively at the level of structural adjustment at the economic & fiscal policy levels. Accordingly, the restructuring at the enterprise is looked up more as re-organisation of the existing structure, re-grouping of businesses including relocations, alliances and mergers etc. to derive the advantages of core competence and market potential in the globalised environment. Basically, Restructuring tries to improve upon what already exists. This may or may not bring a fundamental change and drastic improvements. However, bringing about departmental/functional improvement in an acceptable way is the key essence. The approaches involved may include Automation, Re-organisation, Downsizing, Right sizing, Out-sourcing and Upsizing.

Re-engineering approaches do not accept what already exists and focus on building all together a new business process keeping the customer in mind and taking advantage of the current environment to technology and human dimensions.

### Re-engineering

Michael Hammer (1995) the founding father of Re-engineering defined it as, "Fundamental re-thinking and radical re-design of business process to achieve dramatic improvements in critical, contemporary measures of performance such as cost, quality, service and speed". Though these formulations are well understood by the managers and the executives, in practice, the aspects of "resistance to change" are to be given highest consideration in moderating and modulating the change process by implementing related communication, employee participation, human resources development, empowerment and other TQM processes for meaningful end results. Table 1 presents a broad comparison between some of the popular management tools and techniques viz., Industrial Engineering, TQM, Benchmarking and BPR.

Table 1: IE/TQM/Benchmarking and BPR—A Comparison

Basis of comparison	Industrial Engineering	Total Quality Management	Bench Marking	Business Process Re-engineering
Origin	1950	1970's	1980	1990's
Orientation	Activity/Task	Process	Process	Process
Objective	Eliminate/Combine/Simplify	Improve	Learn	Obliterate
Magnitude of change	Discrete Incremental	Continuous Incremental	Bridge the gap - may be large/small	Discrete Radical & Dramatic
Enabler	No specific enabler	People	Sharing Information	Information Technology
Focus	Internal Measures like Cost & Efficiency	Customer satisfaction Re-position	Customer satisfaction	Customer satisfaction & strategic
Encourage informal organisations	No	Yes	May be	Partly
Empowerment	Negative	Positive	Likely to be positive	Positive
Project Implementation Risk/Return/Time/Cost (1-4 ranks: One being lowest)	1	2	3	4
Techniques	Work Study & Systems	SPC ISO - 9000 QCC etc.	Process Improvement	Process Maps IT & Creativity
Resistance Group	Workers/TU	Middle Management	Staff Specialists (IE/EDP/Accountants)	All !!

### Experiences in Re-engineering

Re-engineering is one of the most controversial management techniques according to extensive surveys undertaken in USA. While a number of US companies have derived dramatic improvements in their business performance, it is reported that several such attempts were either abandoned half way or found to be unsuccessful. The surveys reveal intra-organisational communication as vital to success of BPR exercise apart from having a champion for the proposed change with committed top leadership behind it (Burke and Peppard, 1995). Primarily the resistance to BPR in an organisation stems from the following reasons:



- It cuts across the mental models of all as it is too radical a change
- Basically questions traditions and long held values
- Attempts to revise the behaviour habits
- It shakes the people from the current comfortable positions by challenging inertia.
- It erodes personal power base

In practice BPR has become something like a cult movement and its popularity and credibility are increasingly questioned in USA, where, studies reveal that about 70 per cent of the attempts have resulted in either failures or abandonment mid-way. The prime reasons for this are:

- Inadequate attention to human face by equating Re-engineering with Downsizing
- Application of Re-engineering at lower stages without establishing the strategic relevance of the processes re-engineered.
- Absence of demonstrated commitment and involvement by the top management.

An extensive survey (Coulson-Thomas, 1994) undertaken in the West identifies the following five ways to succeed with Re-engineering:

- Setting aggressive Re-engineering performance target
- Apportioning 20 to 50 per cent of CEO time
- Comprehensive Review of
  - \* Customer needs
  - \* Economic leverage points
  - \* Market trends
- Earmarking additional senior executives for implementation
- Comprehensive prototyping/pilot-project of re-design

Key success factors applicable to a generic organisational environment are given in table 2 and these have to be adopted suiting to culture specific factors.

## Restructuring and Re-engineering in India

### The Onset of Competition

The early part of this decade had been a major turning point in the economic history of India, with the new

**Table 2: Re-engineering: Critical Success Factors**

Focus Process/Attribute/Area	Critical Success Factors
Leadership	Sustained Commitment (to be imaginative & equipped with new skills)
Direction	Vision led & Shared
Motivation	Change Status-quo
Integration	Cover entire Strategic Architecture
Customers	Continuous dialogue
Participation	Involvement of Cross-Functional Teams (Employee involvement/commitment)
Ambition	Goals out of reach, not out of sight
Rethink	Challenge prevailing mind-set
Support	Consultant as devil's advocate (to be headed by internal person)
Communication	Open dialogue thru Change Process (feelings & sensitivities are dealt)
Measurement	Change process & Results
Technology	It as an enabler Need for Orientation & Training
Passion	Ability to enthuse others - (to be open-minded)
Humanity	Human-Face (feelings attitudes, values, behaviours, commitments personnel quality)
Review Process	Authoritative/Comprehensive Ensure Cross-functionalism

economic policy ushering in a "roll back" of the state and greater reliance on the free play of market forces. Though the seeds of liberalisation were sown during mid eighties, serious action started from 1991 onwards. Today there is a sea change in the environment as well as in the mind-set and is characterised by high level of competition, higher consumer awareness and even considerable attitudinal change on the part of the government and society at large. Private and public sector enterprises as well as governmental institutions are facing new challenges of the market environment (Kaura and Pulle, 1995). To facilitate this process of operating under the new paradigms of organisational and market environment by the corporate/private sector and public sector; government has initiated a number of measures namely:

- Throwing open large areas of business to private sector (De-reservation)
- Scrapping of Industrial Licensing
- Dismantling of MRTP regime.
- Virtual removal of Import control

- Progressive reduction of Customs Tariff.
- Promoting Foreign Direct Investment.
- Inviting Foreign and MNCs/Globalisation.
- Reducing Interest on borrowings
- Investor friendly Legislations

Indian enterprises/organisations/institutions are now required to re-think about business strategies, structures and processes, renew and re-position themselves to effectively serve the needs of emerging competitive market and the society. Hence the aspects of restructuring and re-engineering of the enterprise have become more relevant and important in the emerging scenario.

### **Restructuring at National Economy/ Government Level**

The primary need to be more responsive to the needs of its customers namely the people/entrepreneurs/investors and other stake holders, is forcing the government machinery to re-examine its role and restructure itself so as to act as an effective facilitator and propel economic growth through supportive policies. The government is going through a major process of *Restructuring* since mid eighties. These efforts have been further propelled by the recent report of the Pay Commission (A.I.R.F., 1997) directing the Indian Govt. to re-invent itself in the current context. Some of the measures that are suggested are as below:

- Amalgamation of ministries/departments having common and/or related missions and objectives
- Drastic reduction in size
- Drastically changed work environment/methods including automation/reduction of paper work (introducing information technology)
- Autonomy—Delegation of power (empowerment)
- Introducing quick and forthright grievance redressal systems
- Corporatisation of departmental undertakings; disinvestment and privatisation of public sector
- Contracting out some services hitherto provided by Government agencies.

### **Public Enterprises Restructuring**

The new economic policy ushered in the early part of this decade has created a number of challenges to

the public enterprises which were hitherto assumed to be the primary engine of growth of the Indian economy (GOI, 1997). These enterprises are effected by:

- Budgetary constraints restricting the capital outlays for public enterprises forcing them to generate own resources (internal or from the capital market)
- Cut back in the government investment affecting the capital goods and infrastructure based industries.
- Partial dis-investment of the equity.
- Greater emphasis on profitability, growth in return on investment and growth through reinvestment (reduced emphasis on social objective fulfilment).

These factors have thrown up a new set of challenges to public sector manufacturing, services and promotional/developmental enterprises and organisations. This has forced most of the organisations to evaluate and re-position themselves in the changed market & socio-political and socio-economic market oriented situation (Krishnan, 1994). This resulted in the hitherto monolithic public sector enterprises like SAIL, BHEL, ONGC, NTPC, MMTC etc. resorting to restructure and re-engineer their business operations. The services of internationally renowned management consultants (so called big six) are being increasingly sought by PSUs, Govt. Departments and Institutions in this regard. While ONGC has sought the services of Mckinsey, HMT engaged Coopers and Lybrand as their consultants. The financial institutions like RBI & SBI have utilised the services of AF Ferguson and Mckinsey respectively. The infrastructure providing organisations like Electricity Boards in Karnataka and Punjab have utilised the services of KPMG and TCS India. In fact the restructuring and re-engineering has become a major field of management consulting in India not only by MNC Consultants but also by the leading Indian consultancy firms. The primary owner of public enterprise i.e. the Govt. currently is more responsive to put this sector on an increased professional footing through the following measures:

- Enable the enterprise to function on business lines by letting "The managers to manage" so that speed and quick response becomes the hall mark.
- To choose the best of managers and provide them with good Boards.
- Be supportive in all possible ways to make the enterprise function and serve the society

(through disinvestment and privatisation) and make it accountable.

### **Re-engineering: New Agenda for Indian Corporate Sector**

The canvas of massive economic restructuring in India initiated in the eighties and accelerated in 1991 covered a wide range—from delicensing and decontrol to globalisation as mentioned earlier. It had profound impact on the operational structure and style of performance of the private sector enterprise. Indian organisations hitherto thrived through ineffective or inefficient business processes owing to protected and closed economy are now forced to unlearn the ways of doing business, and adopt new approaches by fundamentally rethinking the way they need to operate and meet the current challenges of emerging market oriented economy and survive. In this context most of the large business houses like Tatas, Birlas, Singhanias, Thapars have engaged world renowned consultants like, McKinsey, Arthur Andersen, KPMG etc. to restructure their total business from the angle of identifying their core competencies and re-positioning themselves in the domestic and global environment. A recent study conducted in the area of re-structuring/re-engineering in the Indian context brought out that four components of business operations need immediate re-engineering to cope with the opportunities and challenges posed by liberalisation (Shah, 1996).

These are:

- Business Strategy
- Business Process
- Technology
- Human Resources

Further it is established through studies in some Indian enterprises as well extensive surveys undertaken in the US, the re-engineering process needs to be understood properly and carried out carefully with the commitment of the top management to achieve better results.

While structural adjustment programme to some extent succeeded in reducing trade and fiscal deficits bringing down the inflation rate to single digit and shoring up the real GDP, foreign direct investment, export and foreign reserves, the emerging industrial scenario has raised many issues and concerns of serious consequences for employers, employees and trade unions and the government (Ghosh, 1997). Particularly the issue of employment reduction by restructuring/re-engineering for globalisation has become a major disturbing factor. This fact is further corroborated by Mr. Claude

Smadja, Managing Director of World Economic Forum, in his recent address in India that such effects are being felt by all those economies going through structural adjustments for globalisation. Another interesting development of far reaching consequence in India has been a change in power dynamics and loss of countervailing power of trade unions (Gani, 1996). On the whole, due to the industrial restructuring and the efforts of BPR, the large and medium enterprise in India is fundamentally changing the way Indian firms used to operate and compete. The small and medium sector too is following suit though slowly to keep supporting the fast emerging globalised market.

In a tradition bound Indian ethos and work culture, it is normal to expect high level of resistance to change. Further, BPR type of attempts, being high risk oriented, are likely to be resisted by a low risk taking and hitherto protected enterprise environment. However, a number of attempts have been made to bring radical changes in Indian enterprises and organisations operating under the fold of the large business houses and government departments. One of the early experiences of total Re-engineering was unique experiment and experience leading to "transforming the collectorate of Ahmednagar District in the state of Maharashtra". A champion like Mr. Lakhina, a bureaucrat by profession, totally restructured/re-engineered the administrative functioning (radically different processes) by making it totally customer (public) focused and providing single window service. This was accomplished as way back as in the seventies with professional support from IIM, Ahmedabad. While a list of more recent cases of BPR and Restructuring is fairly long a few typical industrial case-studies are briefly described here.

#### **Mahindra & Mahindra**

The Automotive Division has radically revamped its production system/process at Bombay, Nasik and Igathpuri. The six principles it followed *inter alia* are:

- Build product units
- Create cellular systems
- Deploy flexible processes
- Try to cut cycle times
- Customerise your shop floor
- Your workers own the factory

#### **Hindustan Motors**

At Hindustan Motors, which for a long time enjoyed dominance in the automobile sector, is now faced with

challenges from multinationals. Hence re-engineering was inevitable to cope with the new competition. In a major re-engineering effort, the company has come up with a solution which enables co-existence of different methodologies required for different products. The plant has now been reorganised into three mini plants—one each for dumper equipment, loader equipment and tract-vehicles. The plants in turn are divided into cells, each staffed with multi-skilled workers, and responsible for fabricating and assembling the entire product. The cells are also designed, according to their 'repeater' (several products with sporadic and low demand) or 'runner' (few products needed round the year) nature. The company has achieved work-in-progress reduction by 20 per cent in a short time (Dhawan, 1995).

#### **HCL-Hewlett Packard (now two separate entities)**

At HCL-HP, the objective was to cut the time to design a new product down to three months; to launch a new product in six months; to kill it and launch a replacement over the next three months.

For achieving this, the company has re-engineered the process of information flow from the marketing team to R&D and manufacturing teams. At weekly meetings of cross-functional teams for the marketing, manufacturing and research departments, the marketing team's suggestions are mapped on the spot to the available technologies, which are tracked by a special team. Problems with product designs initiated earlier are also thrashed out. Thus at any point of time, several product designs are in various stages of completion, ensuring a continuous stream of new product into the market. It is reported that new products are being introduced at intervals of four months.

#### **Siemens**

The objective of one of the BPR exercises at Siemens was to improve the installation time and service quality of hi-tech medical diagnostics equipments. Realising that the old process involved too many interfaces between the commercial, service and despatch departments and the customers, bringing in too many people, the company came up with the idea to delink installation from the service department. To ensure process accelerations, a separate project management team and a commercial and technical assistance centre were also formed. This re-engineering effort has brought down installation time from ten days to three and the service engineers have improved their response time to complaints and quality enormously. One of the units of Siemens at Mumbai has totally re-engineered through production shop including its layout, re-arrangement, work reorganisation etc.

Sundram Clayton, manufacturing air-break systems, by employing 820 persons has demonstrated high level of growth through re-structuring and re-engineering. In almost all the cases, renowned consultants were deployed to guide the change management. A select list of Indian organisations attempting BPR is given in Annexure 1.

#### **Culture Specific Issues in India**

The culture specific aspects of Asian countries and, typical to India are the factors that influence the extent of practice of the powerful management tool like Re-engineering. Some of these common factors are:

- Social strata/class ridden society.
- Absence of informality, like, "Don't use Boss's name".
- Age determining wisdom/seniority.

Michael Hammer too has cautioned that the techniques of process redesign are universal while that of change management are culture specific. Hence the need to give utmost attention to culture specific issues of the enterprise/country. In particular, the factors that come in the way of harnessing full scale re-engineering in India could be attributed to:

- Environment inhibiting radical-change (traditional outlook)
- Resistance/anathema to computers/automation
- Restructuring is seen as crude downsizing fearing the trauma of human consequences
- Status conscious and hierarchy bound environment
- Teamless work culture etc.

#### **BPR in India vis-a-vis USA**

The issues that make the practice of Restructuring and Re-engineering in India somewhat different from those in USA are placed at table 3 while the generic approach recommended by Thomas A. Stewart is as below:

- Get strategy straight first
- Lead From Top
- Create a sense of urgency
- Design from outside in

- Manage your consultant
- Combine top down & bottom up initiative

**Table 3: Differing Practices/Approaches**

United States	Indian (Impressions)
<i>Priority</i>	
1. Re-engineering	1. Out-sourcing/Sub-contracting
2. Automation	2. Downsizing
3. Restructuring	3. Restructuring
4. Downsizing	4. Automation
5. Out-sourcing	5. Re-engineering
<i>Propellants</i>	
1. Competition	1. Competition
2. Profitability	2. Profitability
3. Market Share	3. Line with Joneses
	4. Market Share
<i>Speed of Results</i>	
1. One Year & More	1. 3 to 6 Months (Expect Quick/Results)
<i>What Attracts</i>	
1. 50% Executives: 10% Imp.	1. 10% Executives: 10% Imp.
2. 90% Executives: 25% Imp.	2. 40% Executives: 25% Imp.
<i>Span</i>	
Inter-departmental - 40%	Functional - 50%
Cross-functional - 60%	Inter-dept MTL - 40%
	Cross-functional - 10%
<i>Focus</i>	
Understanding MKT	Understanding - Management (Internal System)
Understanding Customers	Understanding - Market
<i>Relative Importance</i>	
Business Goals v/s Process Goals	Business Goals of Paramount Importance
Original Impact & Time Duration Vis-a-Vis Risk & Cost	Risk & Cost is most Important

## Conclusion

The spirit of accepting fundamental and radical change is yet to take deeper inroads in the thinking process of Indian managers, due to culture-specific issues and for fear of adverse impact on human resource. The tendency is to expect quick or immediate results, while the gestation & incubation periods are longer in BPR exercises. As a result, most-interventions are uni-functional and less cross-functional e.g., like inventory management, finance management as against cus-

tomers-order processing. The dominating focus is the end result, rather than the process. The process-oriented thinking is coming-up slowly in the minds of Indian management.

The fast changing market environment is basically forcing Indian management to think about restructuring and reorganising their operations and processes. Computers and use of IT are becoming an inevitable part of the business inspite of the perceived adverse effect on human resource. This is further facilitated by the entry of computer literate youngsters into the industry, due to which even the older employees are going through major learning and orientation to use computers. Functional and process change using computers has become a hall mark even in petty shops, developmental establishments, small and medium industry and even in the Govt. working for e.g., the passport office operations, banks, railways and airlines including single-window services in Government Bhawans.

Considering the gigantic size of operations in India, presently we are at best at the initial stages of introducing IT, to make one or two processes to speed-up a bit. We are far from accomplishing a total fundamental business transformation with dramatic results using IT on the lines suggested Michael Hammer. Even in a country like USA, more of such attempts have resulted in failures than successes. In India, we are yet to reap the full potential and benefits of BPR. However, attempts to transform business will be on the increase due to competition and export-orientation. The new breed of entrepreneurial employees are lending the much needed propellant for this phenomenal change-management.

In the light of the above discussions, a conceptual framework for restructuring/re-engineering has been developed (Fig. 1). As can be seen the four cornerstones of a successful BPR exercise are:

- Customer Focus
- Business Strategy
- Process Innovation
- Change Management

Furthermore, the culture specific issues and technology (specifically Information Technology) which acts an enabler are key constituents of this implementation model.

BPR will be realised in India, only when it amalgamates itself with the basic Indian management practices, as is the normal development process with most

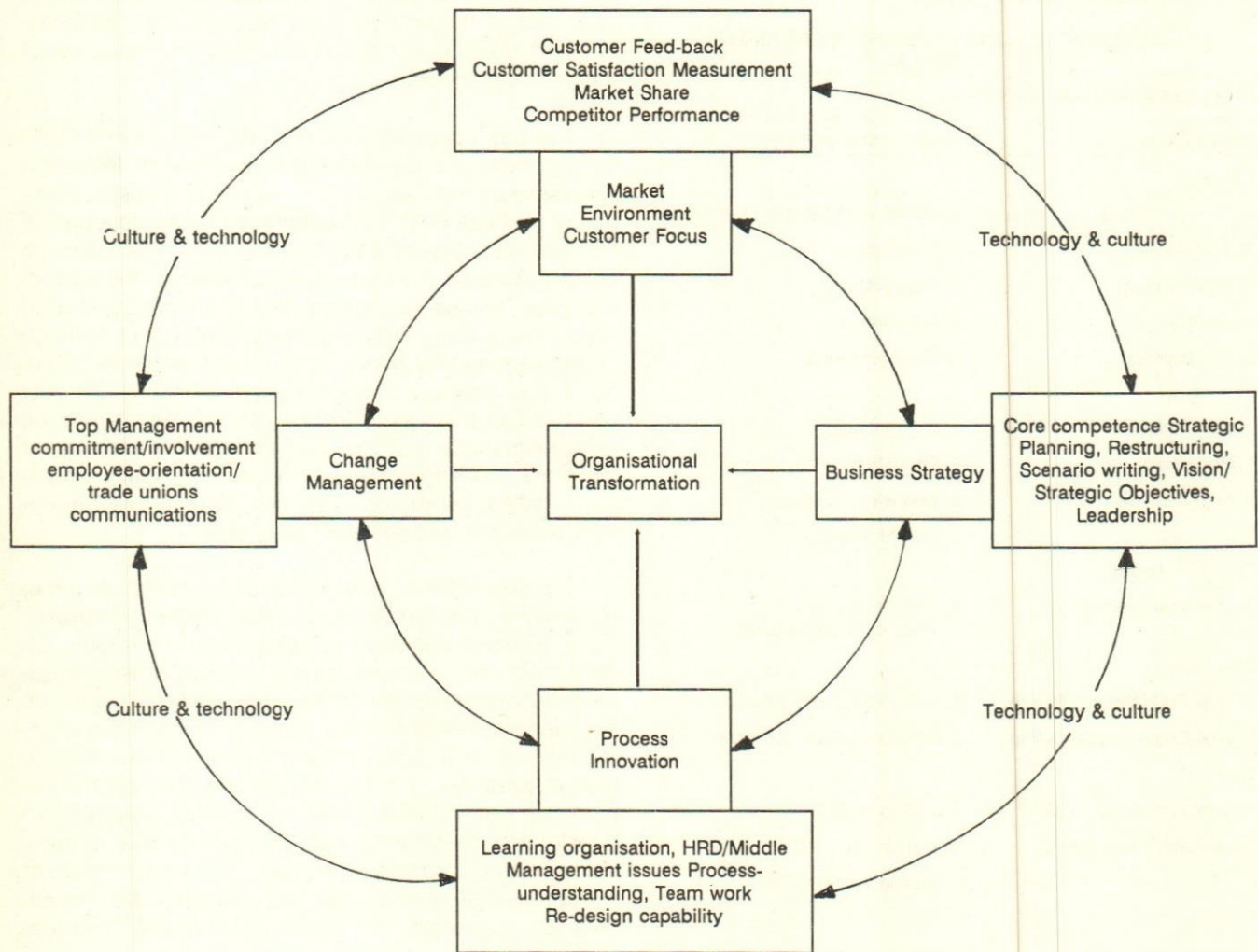


Fig. 1. Organisational Transformation through Restructuring/Re-engineering

techniques. The seriousness and caution with BPR is to be pursued for sustained success is epitomised by Davenport's observation that, "this Hammer (Re-engineering) is incredibly powerful. You can not use it on everything and should be used with considerable care on those core processes of strategic importance."

Furthermore, it is extremely important that restructuring of the organisation goes hand in hand with re-engineering to ensure that the re-engineered processes are absorbed and institutionalised so as to get the intended dramatic improvements.

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## List of Select Indian Business Firms Attempting BPR

Asea Brown Boverly	Mukund Iron
Core Parentals, Ahmedabad	Mahindra & Mahindra
Crompton Switch Gear Division, Mumbai	Modi Rubber
Colgate-Palmolive	National Thermal Power Corporation
Coca Cola	Nicholas Piramal
ELGI Equipments, Coimbatore	NOCIL
Employees State Insurance Corporation	Otis Elevators
Electricity Board, Punjab	Premier Instruments, Coimbatore
Godrej Soaps, Mumbai	PEPSI
GFSC Baroda	Punjab Tractors
Glaxo	Reserve Bank of India
Hindustan Motors, Howrah	Sundaram Fasteners, Chennai
Hindustan Lever Limited	Sundaram Clayton, Chennai
HCL—Hewlett Packard	Steel Authority of India Limited
Indian Oil Corporation	SRF, Chennai
Indfos Industries, New Delhi	Shriram Honda, Delhi
J.K. Industries	Siemens India, Mumbai
Modi Group, New Delhi	TI Cycles, Chennai
Modern Threads	Voltas



# Steering BPR Successfully— The Leadership Imperative

Hemant Kumar Sabat

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*The integration trend of the 1980s culminated in Business Process Re-engineering (BPR) in the 1990s. As the organisations re-engineered, results started pouring in—many efforts at re-engineering have come to naught. For a solid reason—the bottleneck of a bottle is at the top of the bottle, i.e., in the case of re-engineering, the top management carries the process. Re-engineering the management should be concomitant with the BPR effort. In today's turbulent and rapidly changing environment, effective leadership at every level is essential in all organisations. Leadership is not only about creating teamwork and motivating people to make the journey to excellence, it is also about providing clarity of direction, clear goals and a sense of purpose that pervades the whole organisation. Alongside, leadership should strive to develop a high-performance and learning organisational culture while working in association, co-operation, and collaboration with competent people. Culture, the crucial key to success mandates a novel leadership, in the era of integration, acting through a new framework of motivation. Based on this perspective, this paper presents a swift audit of the issues in re-engineering management. A methodology is proposed to measure re-engineering readiness of a business organisation.*

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## Introduction

The modern history of business enterprises has witnessed an unprecedented cycle of *business* revolution in the last three centuries. The first was when Adam Smith propounded his brilliant discovery—the *principle of division of labour*. Since then, the entrepreneurs have humbly transmogrified this principle through its various facets while appertaining it to production line and management echelons—in evolutionary steps. This was the first *managerial* revolution as a consequence of the first *business* revolution. But while doing so, a premium was placed on the process of co-ordinating these tasks and their sub-tasks and combining the results of these tasks into a single output. Further, in this process the “subjectivity of personalities” was lost sight of. In addition, specialisation of labour and consequent fragmentation of work was achieved at the expense of intellectual virtues, and individual autonomy and freedom.

In the changed milieu, change has become perpetual, competition has intensified, and customers rule the roost. The atavistic principles and workstyles are sadly anachronistic and antediluvian. Consequently, the enterprises are supine with plummeting fortunes. And the integration trend of the 1980s has culminated into another business revolution, which in 1990 has been christened by Michael Hammer and James Champy as Business Process Re-engineering (BPR). This is the second business revolution.

Just as BPR had been assuring to be the coveted anodyne and much-awaited elixir for all ills of management, reports about its failures started pouring in (Cooper and Markeus, 1995). It has been emphasised that it is not sufficient to re-engineer just the corporation, what is exigent is to re-engineer the agents of the novel process of re-engineering too (Sabat and Karunes, 1996). In this scheme of things, the priorities that should be devoured on are the purpose, vision and mission of the business enterprise,



the culture of the organisation, the management processes (mobilising, defining, enabling, measuring, and communicating) and leadership styles, and the nature and character of the people working in the organisation.

**The Prologue: The Inclement Weather and The Kernel of the Tornado**

Change is the warp and continuity weft in the many-coloured tapestry of history being woven before our eyes. Without doubt, today's ever-quickening cycle of change is unprecedented. Change today is faster, more erratic, more elemental than ever before. A collision of technological and competitive pressures, and *dictatorship of customeriat* is forming the vortex of what we have begun to call the "information age." The clouds gathering for some time invigorates the ebullient gung-ho disciples of management to frame edicts that solicit to wreck the miasma of gloom that hover over the terrain of management. Management, while sitting at the eye of this whirlwind, is now able to cut through the straws in the wind of the storm—the change—with origins that are

**A collision of technological and competitive pressures, and *dictatorship of customeriat* is forming the vortex of what we have begun to call the "information age."**

stirred by three drivers. These forces – globalisation, technology, and customers separately and in combination – are driving today's enterprises unfathomably deeper into a bailiwick that most of their procurators find formidably unfamiliar. The reality that organisations have to confront is that the old ways of doing business simply do not work any more. On being metamorphosed and twisted into a new shape by fierce global competition, changing markets, and technological breakthroughs, the business organisation of the future is emerging with distinct characteristics. It will be information-based; decentralized, yet densely linked through technology; rapidly adaptable, agile, and extremely nimble; creative and innovative; collaborative; knowledge- and competency-based; and individual autonomy- and freedom-oriented. If there is an inescapable conclusion, it is that all organisations must now redefine themselves. It is pertinent to consider the snapshot of the changing realities – globalisation, technology, the new workplace, the needs of new worker/learner, and new leaders and new competencies – on human resource management practices and organisational processes.

**Globalisation—The Wired Planet**

If there were a single driver that should cause a practitioner to pull back the lens, it is the emergence of a 'wired' planet. Metaphorically, standing at the helm is the 'captain of the ship:' the truly global economy; and its 'lieutenant:' the global business. Most conspicuously, globalisation of business has generated intense corporate realities. Enterprises from all parts of the globe are competing to deliver the same product or service, anytime, anywhere, at increasingly competitive prices. Globalisation is forcing companies to organise themselves in radically different ways. Managerial expertise and talent are critical challenges that are to be addressed today. Managers must be developed to meet the changing, emerging and increasingly complex conditions of the international business community. There is a need to develop managers, leaders and professionals who can shift from a narrow and restrictive "domestic mindset<sup>1</sup>" to a "global mindset." Stephen H. Rhinesmith (1993) displays such a shift.

**Comparison of Domestic and Global Mindsets**

Domestic Mindset	Global Mindset
Functional expertise	Bigger broader picture
Prioritisation	Balance of contradictions
Structure	Process
Individual responsibility	Teamwork and diversity
No surprises	Change as opportunity
Trained against surprises	Openness to surprises

New competitive standards are radically changing Indian workplaces, and, consequently, the values and needs of the new worker/learner. Successful global organisations can only gain a competitive edge through use of strategic workforce management. Critical to the success of developing a truly global organisation will be the linking of human resource functions to the international goals of an organisation and thus framing a partnership to facilitate the design of policies that will support the international growth of the firm as well as

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1. A mindset implies a shared perception by both individual and organisation of the business practices of the organisation.

add value to the development of the individual employee. Rothwell and Sredl (1992) identify globalisation of business (more international markets, joint ventures, overseas ownership, and competition) as one of the thirteen forces likely to affect human resource development. There is a need for the human resource professionals who should be actively involved in business process re-engineering, for the re-engineering process involves the radical redesign of the business policies and practices within an organisation in order to streamline an operation and adapt it to existing market realities.

### **Technology**

Human beings have a long-standing love-hate relationship with technology. Technology improves and extends our lives but at the same time manages to disrupt, impede and even threaten our existence. Alvin Toffler has painstakingly brought out the various repercussions of technology on the society (Toffler, 1970, 1980, 1990 and 1995).

**Human beings have a long-standing love-hate relationship with technology. Technology improves and extends our lives but at the same time manages to disrupt, impede and even threaten our existence.**

The traditional corporate perspective operated in a milieu where technologies evolved gradually, with modest stress on people and organisations. Now we confront the new corporate reality: new technologies dramatically impact organisations, people, products and services, and the human resource functions that support them. Technology, particularly information technology, is not only changing how business is done, products are manufactured, and services are provided, but also it is changing *the definition of the business*. Creation of the information superhighway has stimulated many new applications of technology. More importantly, technology is quickly becoming a critical resource to drive and support human performance. It offers an endless array of tools and processes to support re-engineered human resource functions. Therefore, technology will have to become more integrated with work.

However, there are impediments to technical progress. One is to recognise that the state of technical art is almost always ahead of technical practice,

and new technologies bring conflicts of vested interests and novel fears. Economic and intellectual investments in current technologies can impede technological change. Failure of imagination and nerve, and of thinking beyond an over-reliance on the arithmetic of cost accounting results in an unwillingness to discern the benefits of new technology. The existing infrastructure may put a premium on the compatibility of the two families of technologies—the new and the old. In the end, technical capability requires the synergy of people and technology. If technology is a key driver of *Organisation 2000*, then leaders, managers and professionals need to identify and address specific impediments to technical progress.

**State of technical art is almost always ahead of technical practice, and new technologies bring conflicts of vested interests and novel fears.**

### **The New Workplace**

Traditional corporate perspective holds that work is to be measured in terms of quantity of output and short-term return on equity. The new corporate reality has a new workplace skating on its turf, placing increased emphasis on productivity, performance and return on investment. The new workplace and new worker/learner are clearly a 180-degree turn in another, more responsive direction from the traditional Theory X through Theory Y approaches. Owing to this cultural shift, the most critical challenges facing the new workplace are in terms of performance, quality, involvement, learning, organisational change and results. Rothwell and Sredl (1992) identify three new workplace forces that affect human resource development (HRD):

- Business strategies that concentrate more on human resources and require strategic HRD practices.
- Increased pressure and capacity to measure workforce productivity, performance, cost effectiveness and efficiency.
- Increased need for commitment, meaningful and participation on the job by a larger proportion of the workforce.

The need to build high-performance in the workplace puts a premium on the competencies of the people that are relevant to the new economy. It requires emphasis on learning as the key to future

competitive success. Carnevale (1991) lists sixteen skills, or competencies, as a checklist.

**Sixteen Worker Skills Relevant to the New Economy**

<b>Learning to Learn</b>
1. Foundation
<b>Academic Basics</b>
2. Reading
3. Writing
4. Computational
<b>Communication</b>
5. Speaking
6. Listening
<b>Adaptability</b>
7. Problem-Solving
8. Creativity
<b>Developmental</b>
9. Self-esteem
10. Motivation and Goal Setting
11. Personal and Career Development
<b>Group Effectiveness</b>
12. Interpersonal Skills
13. Negotiation
14. Team Work
<b>Influencing Skills</b>
15. Organisation Effectiveness
16. Leadership

**The Needs of New Worker/Learner**

The needs of increased competition and new technologies challenge the needs of the new worker/learner. In any effort to close the gap between people's expectations and workforce reality, there is a need to take a closer look at the demographics and values of the new worker and his/her expectations for employment. Organisation must move away from often-fragmented training, education and professional development experience, and endorse the broader concept of workplace learning. High-performance work systems and the role of learning should be thought of as synergistic partners. It is clearly emerging that individuals must assume responsibility for learning to learn for personal and professional growth. We need to move beyond the concept of training employees to that of assisting in a continuous learning process. These critical

responsibilities, shared by individual and organisation, are becoming the key driver of the engines in the 'wired' planet.

A fundamental shift in human resource and organisational development strategies is required. Competency modelling is required to drive organisational performance and achieve competitive advantage. A competency-based approach to learning provides opportunities to demonstrate the ability to assess what needs to be learned, select appropriate learning techniques and apply the new learning to the job.

High-technology employees, new professionals and knowledge-workers are making traditional training curricula and methodologies extinct. Professionals require learning methods that address their unique values, preferences and styles. The learning organisation and its new competency-based learning curriculum need to address the unique characteristics of these new professionals.

**New Leaders and new Competencies—'Inveterate' Captains Humbled!**

New leaders with expanded competencies are needed to drive change and shape corporate, national and global economies. Management and leadership development must be business-driven. Organisations need to refocus the management development process on the leadership and management competencies key to their success. The following visual summary of business, technological, and leadership trends serve as a reference point:

**Business, Technological, and Leadership Trends**

<i>Business Trends</i>	<i>Technological Trends</i>	<i>Leadership Trends</i>
Global competition	Creation of the information superhighway to stimulate new applications of technology	New styles of leadership and managerial processes
Radical transformation of organisations		Bet on people, more than strategies
New standards of loyalty and commitment	Synergy reached among people, technology, and work	Emphasis on diversity while managing teams
Focus on business processes		Manage complexity through conceptualisation
Emphasis on productivity, performance and return on investment		Learning through reflection and experimentation
Emphasis on a learning organisation		Flexibility

Champy (1995) identifies the following four different types of leaders:

*Self-Managers:* People who may not think of themselves as managers because, in the last analysis, they answer only for the quality of their own work, such as customer service representatives, researchers, sales people, lawyers, and accountants.

*Process and People Managers:* Those who answer for the work of others, usually individuals, a team, or a group of teams working closely with customers on a specific process.

*Expertise Managers:* Such as technology managers and managers of human resource development programmes.

*Enterprise Managers:* Such as CEOs, division heads, and those with profit-and-loss responsibility.

Global organisations require leaders with global mindsets. Organisations must shift the focus from managers to leaders. Bennis (1990) sets the scene with a differentiation checklist—managers versus leaders. Adair (1997) posits that management is complemented and enhanced by leadership. It is clearly emerging that the new age manager has to manage competitiveness through knowledge by driving for the broader picture; complexity through conceptualisation by accepting the balance of contradictions; adaptability through flexibility by trusting process over structure; teams through sensitivity by valuing diversity; uncertainty through judgement by flowing with change; and learning through reflection by seeking to be open.

## The Heart of Re-engineering Management

### What Is Re-engineering?

"If you are the first to see a snake, kill it." This is the metaphorical expression for re-engineering. Nonetheless, it is the essence of re-engineering. At most mass-production corporations, if one sees a snake, the first thing he does is go and hire a consultant on snakes. Then he gets a committee on snakes, and then discusses it for a couple of times. The most likely course of action is nothing. There is a need for a management system where the first person who encounters a problem is also able to take care of it. This is the essence of re-engineering. At the kernel of the phenomenon is *process reintegration*.

Hammer and Champy (1994) offer the following definition:

"Re-engineering is the fundamental rethinking and radical redesign of business process to achieve dramatic improvements in critical contemporary measures of performance, such as cost, quality, service and speed."

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Adding a few more dimensions to the above definition, Talwar views the real challenge in re-engineering to be one of:

"Changing mindset, attitude and behaviour to allow the fundamental rethinking and redesign of business activities, structures and working relationships in order to maximise added value and achieve radical and sustainable improvements in all aspects of business performance" (Coulson-Thomas, 1994).

That is, the focus of BPR is on core business processes. It forces each company to define what processes make up the core of its activity. Then BPR makes the company focus on these core business processes, and to think how it can effectively feed resources into these core business processes. In effect, BPR solicits to change the vertical functional pillars of traditional industries into horizontal tubes of process-oriented organisations.

Zeleny (1995) documents the three components of re-engineering as:

*Reintegrating the task:* Combine smaller process sub-tasks and sub-activities into larger, integrated units and packages. The management should reduce the number of parts, components, segments and constituents in products and processes as well as reduce the number of parts in products and processes.

*Reintegrating the labour:* Allow the workers to perform and co-ordinate larger rather than smaller portions of the process. The management should encourage multifunctionality, job rotation, de-specialisation and integrated process design. Let people work in autonomous teams and co-ordinate an integrated process rather than labour individually on atomised and linear assembly lines.

*Reintegrating the knowledge:* The workers must know and be able to co-ordinate successfully larger and

larger portions. Knowledge is the ability to co-ordinate one's action purposefully. If one is specialised, atomised, and reduced to a machine appendage one cannot co-ordinate action, but only perform single and simple commands. There is the need for an integrated rather than specialised education.

### Power Shift and the Components of Re-engineering Management

Matching the external power shift from management out to the free markets (thereby making the customers the "old" captains' new captains), there is a concomitant internal power shift—the traditional byzantine command-and-control system is in the throes. The democracy of customers summons a meritocracy of people and producers. In this context, while we recognise that it is a tactical necessity to embark on the novel process of re-engineering, it is pertinent to churn out the issues that are relevant to re-engineering management.

Dwelling on the priorities that our mind should devour on, the issues in re-engineering the management churn out to be (Fig. 1):

Purpose Vision and Mission of the Business Organisation	:	What is this <i>business</i> for?
Culture of the Business Organisation	:	What kind of <i>culture</i> do we want?
Managerial Processes and Leadership Styles	:	How do the managers do their <i>work</i> ?
Competencies—Nature and Character of the <i>People</i> in the Organisation	:	What kind of <i>people</i> should work in the organisation?

With the help of Need-Expectancy-Achievement-Reinforcement Framework of motivation (Fig. 2), the issues relating to re-engineering management has been extracted (Table 1).

#### Purpose, Vision and Mission of the Business Organisation

The first query is devoted to the greatest management tool of all: leadership; and to the newest responsibility of leadership: to explain what is going on, to everyone. This gift has been doled out by the changed milieu in which a modern business organisation is expected to operate. What the manager aims at doing with his or her expression of the purpose of the company is to mobilise the talent and energies of people—first in the ramparts of the company and then extending outward to suppliers and vendors. Without first establishing what the business is for,

where it fits in a commercial scheme of things, and where its managers hope it will fit, this gets stifled at birth. Concomitant with this is the manager's vision to invigorate and impel each and every employee to the task. For this it is quintessential to establish a sense of personal significance—significance in and to the corporation—in the hearts and minds of every employee. This significance lies partly in how the new purpose and vision will affect the work and partly in changing the culture of a re-engineered company.

#### Culture of the Business Organisation

Skimming re-engineering premise drives us toward one solid conclusion: the rules of governance (and self-governance) for effective business enterprises today are being determined not by their organisational structure, but by their culture, which comprises the deeply shared values and beliefs of its people, which show up in how the company and its people behave. Specifically, these values include human virtues—openness, trust and trustworthiness, self-respect and mutual respect, cooperativeness, accountability, as well as the willingness to judge and be judged, and reward and be rewarded—and work values (competency, adaptability to change, decisiveness, boldness and valiance, *inter alia*).

As always with re-engineering, managers cannot force this set of principles of desired behaviour on people; at best, they can lead the way by 'modelling', enabling and educating the people. Then, communication is the critical activity in cultivating desirable values, and words must be followed by deeds. Further, identifying the values that define a culture of re-engineering—that is, a culture that willingly embraces the need for constant change—is only a necessary first step. To make those values and that culture thrive within the corporate community, requires teaching, doing and 'living' at all levels of the organisation, at all times.

#### Re-engineering Climate

Organisational climate, usually measured by a survey, is employees' perception of organisational factors that predict performance. Successful re-engineering efforts are to be predicated on the following climate dimensions:

*Standard:* It is the extent to which people perceive the way management sets high standards and challenging goals, the extent to which people perceive objectives for the re-engineering efforts are clear and challenging, and the extent to which people perceive improvement against standards is continually encouraged.

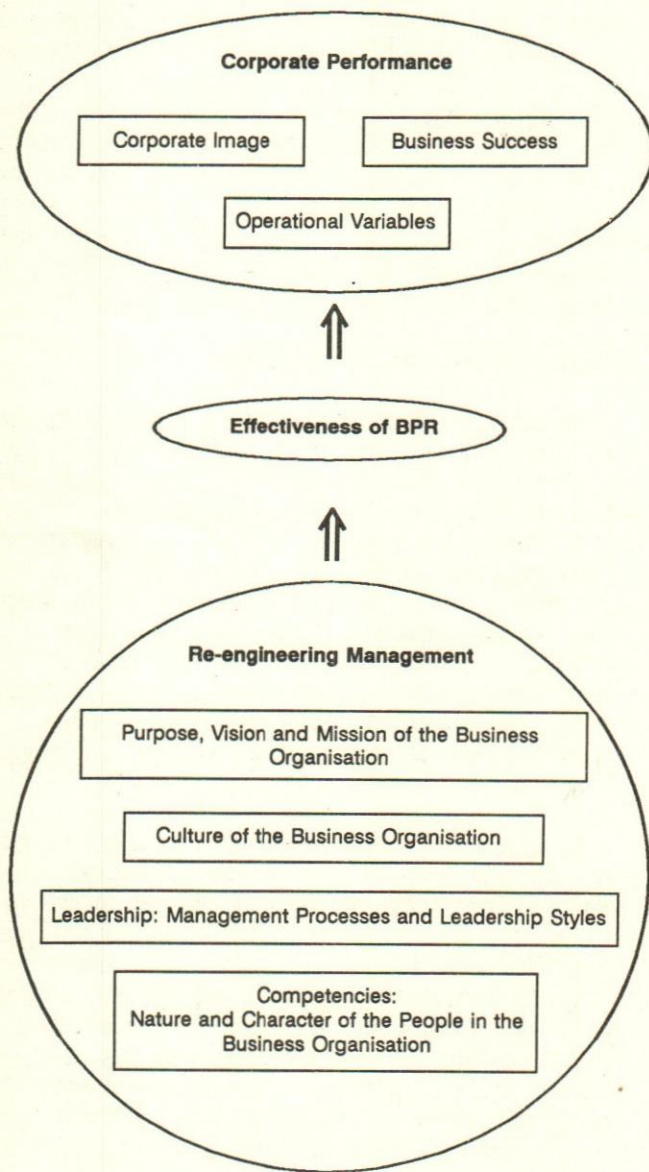


Fig. 1. Relationship between Re-engineering Management and Effectiveness of BPR

**Clarity:** Clarity is the extent to which people are clear about procedures and expectations, about the vision, importance, specific objectives, methods of the re-engineering effort, and about their roles and responsibilities.

**Rewards:** It is the extent to which allocation of rewards is perceived to be based upon superior performance, i.e., whether the team members who contributed the most to the team's success (by offering new ideas, working long hours, championing changes) receive the most rewards by way of training oppor-

tunities, additional responsibility, celebration parties, and so forth.

**Team Commitment:** It is the feeling that management and fellow employees co-operate to get work done. Expression of considerably higher levels of pride, loyalty, commitment, and discretionary effort exhibited by their willingness—over and above what was necessary to keep their jobs and collect their paycheques—to help the re-engineering effort succeed is to be measured.

**Collaborativeness:** It is the ability to work co-operatively with diverse co-workers in multidisciplinary teams while exhibiting positive expectations of others and interpersonal understanding.

**Information Seeking/Ability and Motivation to Learn:** An obvious predictor of flexibility is genuine enthusiasm for opportunities to learn new technical and interpersonal skills. An example is the secretary, who when asked to learn a spreadsheet programme and take on budget data analysis, welcomes this request as job enrichment rather than seeing it as an additional burden. This competency transcends computer literacy and other specific technical skills future workers are likely to need—it is the impetus for lifelong learning of any new knowledge or skill demanded by the changing requirements of future jobs.

**Work Motivation:** Under time pressure, work motivation requires some combination of achievement motivation, need, expectancy motivation, reinforcement motivation, flexibility, stress resistance, and organisational commitment that enables individuals to work under increasing demands for (new) products and services in ever shorter periods of time.

#### Management Processes and Leadership Styles

Every business has core management processes. Champy (1995) enlists them: mobilising, enabling, defining, measuring, and communicating. The underlying precept is to emphasise on association, collaboration and co-operation to beget inspiration and support as well as raise morale, the ultimate moral conditions of success. Enabling, or more fashionably called empowering—providing the wherewithal—requires redesigning the work so that people can exercise their skills and capabilities to the extent possible. Radical change insists on radical goal definition, that is, subjecting decision-making to a ruthless and continuous judgement by results while examining the nitty-gritty of the process. A company's performance is to be measured not by the tyranny of the numerical accountancy but by the judgement by the customer. Today an attempt is made to measure leadership, co-operation, decisiveness and the like that are hard

to quantify—this is certainly a stupendous challenge. Finally, it is authentic communication that brings people together into a community—listening, responding, confronting, asserting and disputing—engaged in the perpetual process of change.

### Leadership Styles

Statistically, four leadership styles distinguish successful from unsuccessful re-engineering leaders.

**Authoritative:** An authoritative leader is one who provides a long-term vision; gives employees clear direction. The authoritative leader continually communicates a vision of what the re-engineering effort is trying to achieve and why it is critically important to the firm that it succeed. Whys tend to be either a great opportunity ("If we pull this off, we'll be number one in the world!") or a great threat ("If we don't make this work, in six months we will be out of business"). By contrast, unsuccessful re-engineering leaders never make their vision clear—as measured by the clarity dimension of organisational climate.

**Affiliation:** An affiliation-leader maintains good per-

sonal relationships among employees by listening to their concerns and expressing sympathy during times of stress, cares about their people, supports them, and expresses personal concern and sympathy with the changes they are going through.

**Democratic Participative:** Such a leader builds commitment and generates new ideas by encouraging employees' participation, welcomes input from all team members regardless of their position in the organisation as well as from top executives and end-user customers. No good idea is ignored.

**Coaching:** A coach-leader develops others, helps employees identify their unique strengths and weaknesses, makes many development opportunities available to their colleagues, including formal training in both hard and soft re-engineering techniques and technologies (e.g., team building and LAN administration); they also provide advice and feedback to individual members to help them improve their performance.

### Competencies: Personnel in Business Organisation

It seemed so much simpler in the days of the old

**Table 1:** The issues in Re-engineering Management

Purpose, Vision and Mission of the Business Organisation	Culture of the Business Organisation	Leadership—Management Processes and Leadership Styles	Competencies—Nature and Character of the People of the Business Organisation
Standards of excellence Management credo for striving for relentless betterment Vision and purpose Clarity of goals and specific objectives Commitment of people to organisational and societal objectives Defining the operational processes Devotion (to growth or service?)	Directness and openness Learning culture Corporate spirit of learned willingness and individual acceptability Employee participation Team commitment Risk and initiative-taking culture Strategic mindset of managerial betterment (adversarial/competitive and/or supportive) Organisational thinking (radically experimental and discontinuous or perfectionist) Ethics (adversarial versus supportive) Capability to adopt, adapt and implement changes Chaos handling capability of the firm Cultural diversity of workforce Faith in human beings To judge and willingness to be judged Performance unto the highest competence Corporate discipline (or reflexive obedience) Extent of enabling the people Trust and be trustworthy Organisational flexibility	Mobilizing (influence, motivation, persuasion) Defining Enabling/empowering—dissemination of authority, control and accountability Communicating—clear and authentic Measuring—customer-service orientation Change implementation leadership Relationship management Interpersonal understanding Increased risk and initiative-taking Compensation Commitment of the people to the organisational goals Customer service orientation Creative conflict resolution Interpersonal understanding Rewards and recognition to individuals and teams Change and implementation leadership Clarity and authentic communication	Directness and openness of people Interpersonal savvy Leadership qualities Managerial potential Team work qualities Capacity of independent thought Team commitment (team orientation and team co-operation) Thinking (discontinuous radical, and analytical) Resourcefulness and adaptability Sense of responsibility Reliability and Maturity Judgement Decision-making ability of the people Flexibility and willingness to change Risk and initiative-taking Self-confidence Technological know-how Achievement orientation Communication ability Rewards and recognition to individuals and teams Degree of innovation Portability

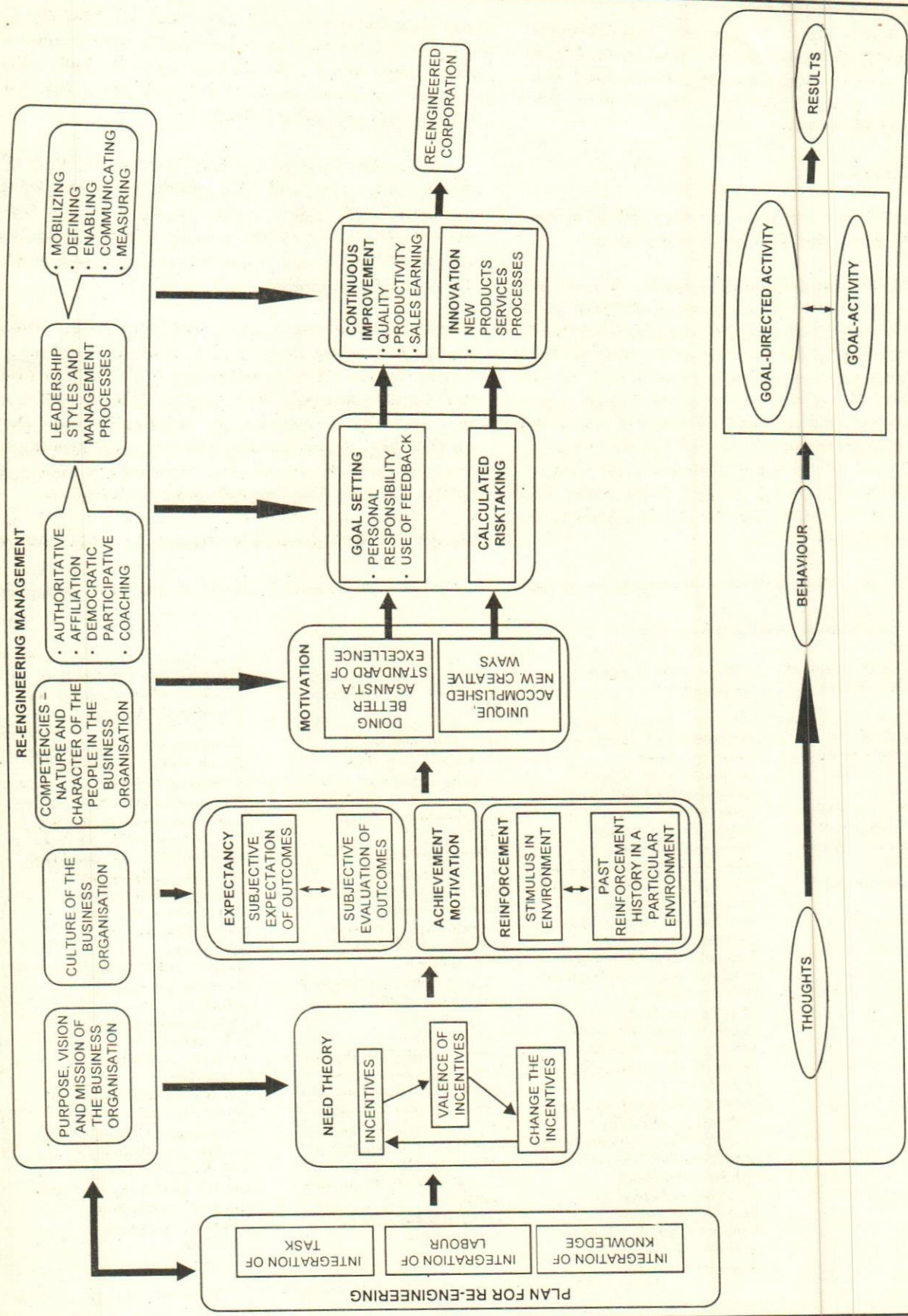


Fig. 2. Need-Expectancy-Achievement-Reinforcement Framework for Re-engineering Management



corporate 'machine:' since managers hired people to work for the company; they chose, judged and rewarded them for their ability to perform a specific task. Re-engineering demands that people are hired to work under the rubric of *association, collaboration and co-operation with the managers*, as part of a community of shared aspirations, ideals, and trust. Further, today business concerns need people who add value to every process they touch, and who bring values to the company.

In this changed scenario, selection, recruitment, training, development and deployment, the age-old managerial prerogatives are being termed now by a new tool kit of processes re-engineered to recognise the change, and by a new covenant between a company and its employees. In this memorandum of understanding, competencies are the currency exchanged between employees and the organisation. The competencies that the managers must possess are as follows:

### **Self-Managers**

*Achievement Orientation:* It is thinking about doing better against a measurable standard of excellence.

*Analytical Thinking:* It is the ability to break complex problems (e.g., work flows) into their constituent parts and arrange them in hierarchical, time sequential, and causal order. Analysis of hierarchical order requires the ability to prioritise (A is more important than B more important than C). Analysis of time sequential order requires the ability to play out workflow process steps in sequence (Do step A before doing step B before doing step C). Analysis of causal order requires the ability to recognise If = Then relationships (If A happens, then B is likely to happen; or if X happened, it probably was caused by U and V).

*Customer Service Orientation:* It involves proactively going out and asking downstream customers how you can serve them better (e.g., change your process or outputs, get customers better inputs just-in-time). Less successful re-engineering leaders react to down stream customers' request for better service or inputs initiated customer contact to find out how they could help.

*Influence and Persuasion:* They should persuade people (over whom they do not have direct authority) to co-operate with the re-engineering effort by emphasising the benefits, create compelling visions that motivate multidisciplinary team members to align their interest and work for shared project goals. Also build political coalitions of process workers and customers to lobby for the funds, computer equipment, and other resources necessary for success.

*Initiative:* They should take action, push, wheedle, and cajole to get colleagues, employees, suppliers, and customers to adopt new methods.

*Team Orientation:* They should exhibit much team-building behaviour.

*Discontinuous Thinking:* They should continually act as devil's advocate, proposing radical alternatives to the way work is done and challenging colleagues to eliminate work that doesn't need to be done.

*Technology Know-How:* They should have the knowledge of cutting-edge management techniques and technologies; read management and computer journals; and enthusiastically promotes the benefits that the latest techniques and gadgets offer.

### **Process and People Managers—Supervisors and Middle Managers**

Supervisors and middle managers traditionally plan, organise, motivate, control (check up on and reward or punish), and co-ordinate. In re-engineering jobs and process teams, empowered workers will perform all these functions for themselves. Competencies needed by supervisors and managers in re-engineered organisations include:

*Empowering:* It involves sharing information, soliciting co-workers' ideas, fostering employee development, delegating meaningful responsibility, providing coaching feedback, expressing positive expectations of subordinates irrespective of diversity differences, and rewarding performance improvement. Such managerial behaviours make employees feel more capable and motivate them to assume greater responsibility.

*Team Facilitation:* leaders need group process skills to get diverse groups of people to work together effectively to achieve a common goal: establishing goal and role clarity, designing effective work flow processes, controlling excessive talkers, inviting silent members to participate, resolving conflicts.

*Flexibility:* As always, the willingness and ability to change managerial structures and processes to implement organisation change strategies is of paramount importance.

*Change Implementation:* What assumes significance is the ability to communicate to co-workers the need for change in the organisation and facilitate training process to implement change in work groups.

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*Entrepreneurial Innovation:* Success culture stresses on the motivation to champion new products, services, and work flow processes.

*Interpersonal Understanding:* It is clearly emerging that the ability to understand and value inputs of diverse workers has a synergistic value.

*Portability:* One of the key drivers to competitive success is the ability to adapt rapidly and function effectively in foreign countries. This competency is correlated with a liking for travel and novelty, resistance to stress, and cross-cultural interpersonal understanding.

### **Expertise Managers**

*From Individual Contributors to Team Players and Leaders*

Re-engineered work in process teams requires a much higher degree of teamwork and co-operation.

*From Individual Contributors to Consultants*

Human resource legal, corporate, planning and marketing research staff who now work as individual contributors, will increasingly become consultants to line managers and employees. Competencies required to make this transition include consulting, help desk skill, and teaching and training competencies.

### *Knowledge Engineers*

Technical professional practitioners also will increasingly become "knowledge engineers" who build expert systems or consult to those who do. Competencies to become expert system developers—for example, developers of interactive, multimedia training programmes on CD-ROM to support distance learning—include a much greater degree of information technology know-how, information seeking, conceptual thinking, and computer-programming skills.

### *Enterprise Managers—Executives*

Top management will change from controllers to leaders. The three most important competencies identified for executives of the future are:

*Anticipatory Strategic Thinking:* They should have the ability to understand rapidly changing environmental trends, market opportunities, competitive threats, technological advances, and the strengths and weakness of their own firms in order to identify the optimum strategic

response. The best executives have long-time horizons—they see farther into the future and are capable of handling greater cognitive complexity.

*Change Leadership:* Top management should have the ability to communicate compelling vision of the firm's strategy, which arouses the motivation and commitment of its many stakeholders and makes adaptive responses both feasible and desirable. Executives must sponsor innovation and entrepreneurship and allocate company resources optimally to implement frequent changes.

*Relationship Management:* They should have the ability to establish relationships with, and influence complex networks of others whose co-operation is needed for the organisation to succeed, and over whom the executive has no formal authority. These include product champions, customers, stockholders, labour representatives, government regulators at all levels, legislators, and interest groups in all countries around the world. Kotter has called this ability "spider web" management of a "dependency matrix", meaning all the competing individuals and groups the executive is dependent on to achieve his or her objectives.

### **Dimensions of Re-engineering Readiness**

Four dimensions determine the success of re-engineering initiatives (Fig. 4):

- Purpose, vision and mission of the business organisation
- Competencies—nature and character of the people of the business organisation—personal characteristics that have been proven to predict outstanding performance
- Leadership—management processes and leadership styles
- Culture of the business organisation—the atmosphere of the workplace or how people feel about the workplace

The re-engineering readiness provides both detailed and overall measurements of re-engineering readiness at three levels. The first level assesses a manager's use of competencies of people in the organisations along with the leadership factors and is designated as "*re-engineering management index*." The second level measures the dimension of the "*organisational climate index*." The third level—"*re-engineering readiness index*"—represents the intersection between the two indices, which in effect is an intersection of manager's use of competencies and leadership, and the climate he has

**RATING SCALE**

1. NOT EXISTING
2. RARELY
3. SOMETIMES
4. OFTEN

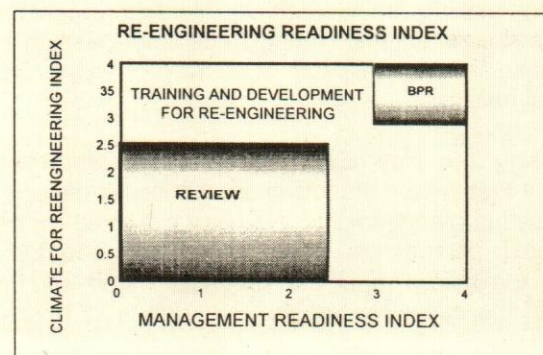
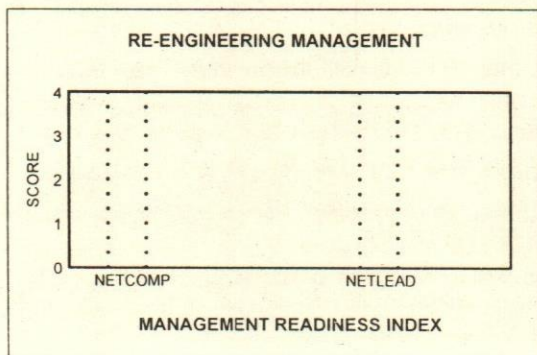
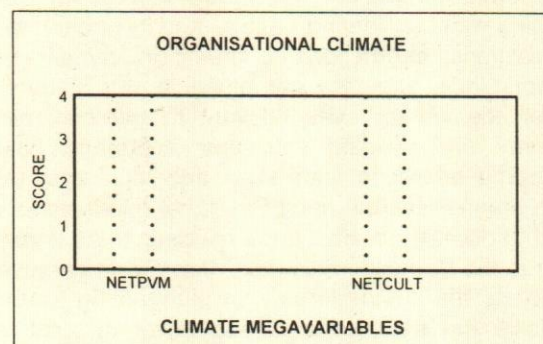
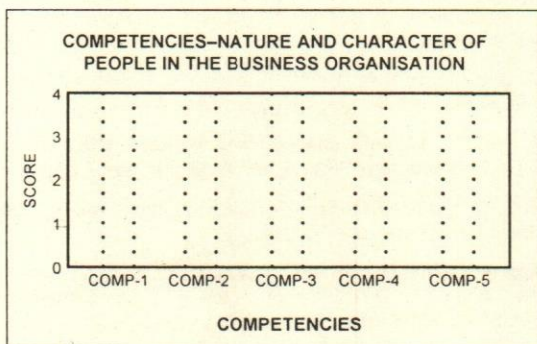
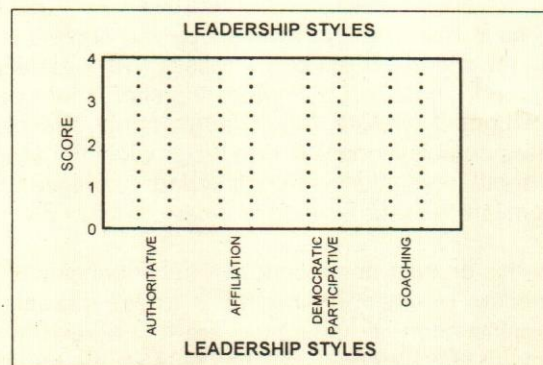
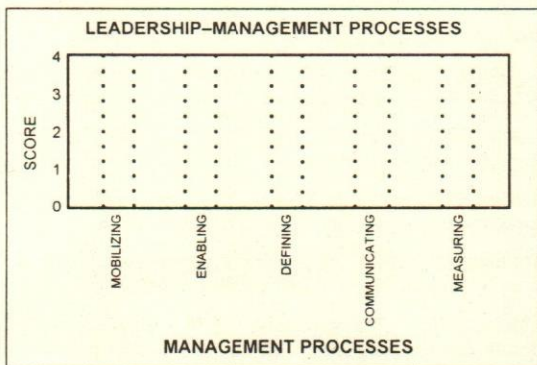
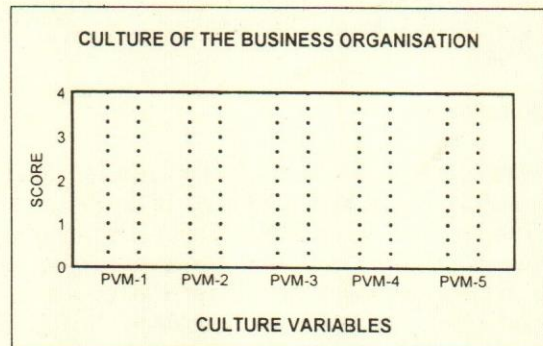
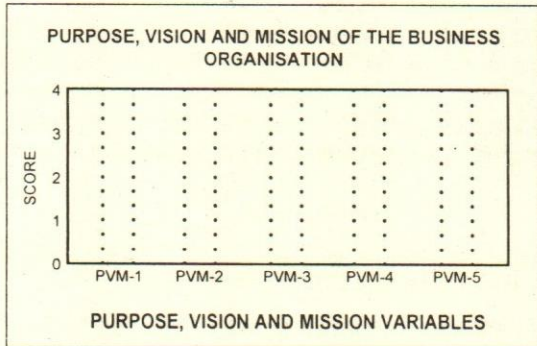


Fig. 3. Re-engineering Readiness

created. It predicts to go in for BPR when all the four dimensions are at an optimum level for re-engineering. It suggests a re-examination and identification of elements that need development if the indices assume intermediate values. If the indices are poor, the measure suggests: strengthen the applicable skills of management and review all the other dimensions too.

## Conclusions

Twice in the history of modern enterprises, the firms of the world have been in the throes of business revolution. The first was when Adam Smith propounded the *principle of division of labour*. However, owing to the failure of this paradigm to deliver the goods in the changed milieu, in which the business organisations now operate, the atavistic principles and work-styles, which are anachronistic and antediluvian with the zeitgeist, have been rightly replaced by the second *business revolution—Business Process Re-engineering (BPR)*. Sadly, umpteen re-engineering efforts have come to a naught. Therefore, the strategic imperative of the business organisations is to don the cloak of the second *managerial revolution—re-engineering management—concomitant with the second business revolution*.

In this context, the incumbent contingencies to aid the modern business organisations to sail through the burgeoning aeon of integration are to be seen in the light of the new corporate realities vis-à-vis the traditional corporate perspective. These are: technology that is changing with bewildering rapidity, and its impact on the organisations, international competition, dynamism in the workplace, and new competencies for leadership. Further, the worker skills relevant to the new global economy are learning to learn, academic basics, developmental issues, team skills, and influencing skills. It also emphasises the need for global mindsets as opposed to domestic mindsets—a mindset at the kernel of which is the domestic bailiwick—that are imperative to resuscitate the supine firms with plummeting fortunes. To tackle the new exigencies a novel mindset with respect to the thinking of the corporacies in terms of decision-making, inter-functional interaction, collaborative versus adversarial strategy, customer-oriented performance evaluation, and system monitoring, is a tactical necessity.

Using the Need-Expectancy-Achievement-Reinforcement Framework of motivation, the issues relating re-engineering management have been extracted from the aforesaid perspective. They have been categorised under the macro-variables—*purpose, vision and mission* of the business organisation, *culture* of the busi-

ness organisation, *nature and character* of the people manning the organisation, and *leadership—managerial processes* (inspiring, defining, empowering, communicating, and measuring) and *leadership styles*—that are inherent to the effective functioning of any organisation. A suggestive measure of *re-engineering readiness*—the direction in which the effort at re-engineering the corporation will be successful—of a firm has been proposed in conclusion. Re-engineering readiness is measured in terms of the macro-variables, which in turn, are measured in terms of a number of variables.

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# Business Process Re-engineering and Supply Chain Management Systems

Santosh S. Venkatraman and Albert A. Blum

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*Organisations, all over the globe, are striving to enhance their productivity in order to stay competitive. Due to intense global competition, organisations must use every possible measure to enhance product quality, a decrease product costs. Managing the supply chain is an effective method to reduce operational costs and increase customer satisfaction simultaneously. Modern, state-of-the-art, computerized Supply Chain Management (SCM) systems use sophisticated communication networks and computer software, to improve the way an organisation deals with entities in its supply chain. SCM is rapidly becoming a very powerful weapon because it reduces inventory costs, and increases responsiveness to changing market conditions. The present paper discusses the major issues regarding supply chain management, indicating how organisations can re-engineer their supply chain management processes to enhance their competitiveness.*

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## Introduction

Practically every organisation taking cue from the concept of open economy is frantically shifting focus from regional and local markets to global markets. While globalization does indeed open the doors to massive worldwide markets, it also creates an environment for unprecedented competition from all corners of the planet.

Along with sophisticated organisations, customers, too, are becoming increasingly sophisticated. They demand high quality products and services at rock bottom prices. The widespread use of communications technology, such as the Internet, World Wide Web, and cable television, along with sophisticated marketing techniques, has made consumers extremely aware of their choices. Consumers have abundant choices, and do not tolerate poor quality products or delays in shipping. To survive and thrive under highly competitive market conditions, organisations must strive to enhance their market responsiveness, and their productivity. Outdated and uneconomical business processes must be re-engineered.

**To survive and thrive under highly competitive market conditions, organisations must strive to enhance their market responsiveness, and their productivity.**

A major problem that plagues many organisations, especially in the manufacturing sector, is the process of managing supply chains. In a global economy, the management of supply chains not only involves crossing channel (manufacturers, retailers, distributors, and third parties) boundaries, but also

crossing functional, cultural, and personnel boundaries. Problems in the supply chain result in costly internal problems such as excessive inventory costs (resulting in lower earnings) and delays in fulfilling customer orders.

In the present paper significant innovations, like the infusion of information technology, in supply chain management (SCM) have been suggested as the process of managing all aspects of procuring materials and supplies from the source to the delivering of the final goods to the consumer.

### Supply Chain Management

This has its origin in Europe, through a software company called SAP (Fortune, 1997). But interest in the concept is spreading rapidly to all corners of the world. Today, more than 8000 companies in over 50 countries use SAP.

A supply chain is a business process that links manufacturers, retailers, customers, and suppliers in the form of a chain to develop and deliver products as a single virtual organisation of pooled skills and resources (Kalakota and Whinston, 1997). SCM is the process of synchronizing the flow of physical goods and associated information from the production line of low level component suppliers to the end-consumer, resulting in the provision of early notice of demand fluctuations and synchronization of business processes among all the cooperating organisations in the supply chain. Effective SCM results in the significant reduction of both cost and time in the procurement process, as well as much lower inventory levels, thus enabling significant gains in organisational productivity.

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The unpredictable nature of supply plays a critical role in traditional inventory management. In the course of operating a business, purchase orders seem to get misplaced or lost, checks seem to go astray, and procurement personnel end up 'guessing' order quantities (due to unreliable information). The result is that, while some business units are scrambling to acquire certain parts needed for immediate

production, other units are wondering what to do with their unused inventory.

In order to counter the effects of suppliers experiencing production problems or to deal with unforeseen delays in shipment, inventory managers typically maintain a "stock" inventory to sustain planned production levels. Further, when set-up times are long, there is a need to have high levels of work-in-process inventory to keep production running smoothly. The excess inventory built up due to uncertainty not only significantly reduces working capital and net income, but also increases the risk of ending up with 'obsolete' material.

Inventory obsolescence is a major problem for manufacturers and distributors of high technology equipment, such as microprocessor chips, modems, and personal computers. The value of high-technology inventory falls drastically with time. For example, the Intel Pentium 200 MHz microprocessor chip fell drastically in value with the introduction of a faster chip (the Pentium II 233 MHz Chip). Having an excess inventory of the old Pentium chips will force an organisation (for example, Gateway 2000 Inc.) to reduce the price of the 200 MHz chip in order to get rid of it (resulting in very low margins). The recent fall in Gateway 2000's profitability (and its stock price) is primarily due to obsolete inventory in its warehouses. Another disadvantage of maintaining large inventory levels is reduced market responsiveness. If market conditions change, it would be too expensive to simply "dump" the existing inventory and then change directions.

Managing a supply chain is not, however, as simple as it used to be a few years ago. The rapid adoption of lean manufacturing techniques like 'just in time' (JIT) inventory management, and flexible manufacturing systems have made the timeliness of materials delivery extremely critical. Flexible Manufacturing Systems (FMS) allow organisations to produce customized products and still remain cost competitive. Products are manufactured only when customers place orders. As manufacturers become increasingly reluctant to carry large inventories, suppliers must be willing and able to make smaller, more frequent deliveries, and do so in a timely manner. Timeliness has become even more important than cost to modern manufacturers who adopt lean manufacturing techniques (Parker, 1996).

In traditional supply systems, suppliers and manufacturers operate in a rather autonomous manner. Suppliers have very little information on what manufacturers need until they receive orders from manufacturers. Similarly, manufacturers do not know what materials suppliers have

available until they place an order, and get a corresponding response. For organisations that implement computerized supply chain management systems, the links in the supply-chain become truly intertwined. Suppliers and manufacturers do not just share a business relationship, but also share confidential, critical information, via computer technology.

With well-implemented supply chain management systems, manufacturers do not even have to place orders manually. The supplier's information system is 'aware' of the manufacturers' demand at all times because it communicates with the manufacturers' production information system. Consequently, the supplier knows exactly what materials the manufacturer needs, and when they are needed. Much of the unpredictability that is present in traditional organisations is eliminated. The result is a much more stream-lined, and cost-effective production facility.

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## Solutions

Linking manufacturers and suppliers via communications networks computer software is not a new idea. What is new, however, is that modern SCM systems enable a high degree of integration between the various systems of all partners in the supply chain. Electronic Data Interchange (EDI), which is the most common form of electronic link today between organisations [Mathews, 1998], is used mostly for limited exchange of business information, and conduct simple business transactions (such as electronic fund transfer). SCM not only has all the advantages of EDI, but also allows a much high degree of automation and streamlining (Achrol, 1997). The biggest problem with current EDI systems is incompatibility among systems (software, hardware, and communication network protocols) of various business partners. EDI, therefore, has been embraced only by larger organisations because of the complexities and costs involved in developing custom software, and networking solutions.

Current SCM systems aim to solve many of the aforesaid problems by creating software that will integrate the systems of different manufacturers and

suppliers. The breakthrough in supply chain management comes from advanced computer software that falls into one of two categories: enterprise resource planning (ERP) and Planning Engine Applications (PEA). This is made by vendors such as i2 Technologies, Manugistics, Numetrix, and Q-CIM, support and integrate transaction-based processes. Enterprise resource planning solutions, a popular category of enterprise software made by companies such as SAP, Baan, and Oracle, organizes and interconnects most day-to-day tasks, such as entering orders, tracking product shipments, scheduling production, and updating sales forecasts and balance sheets [EIL, 1997]. With ERP software, previously incompatible systems can be tightly integrated.

These software modules are nested with ERP programs like SAP [Appleton, 1997]. Sales of PEA software the i2's Rhythm amounted to \$420 million in 1996; it may reach \$1 billion by the end of 1998 at a compound annual growth of 67%.

ERP software, on the other hand, is expensive. It costs about \$US 10 million to \$US 40 million and about 4 years to implement. It is estimated that it takes about 9 years to achieve a return on the investment. In contrast, planning engine applications software can be implemented in about six months, and ROI can be achieved in about one year.

Lack of training is seen as the single biggest inhibiting factor on supply chain management growth (Appleton 1997). Very few people are trained to implement and use these advanced software systems, and companies like Anderson Consulting are reaping massive profits in the training and education business.

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In the initial stages of planning a supply chain management system, computerized modeling is used to test scenarios, and 'what if' analyses are conducted (Hough, 1996). When supply chain management is combined with other inventory models such as JIT (just in time), production may have to be adjusted on a daily, if not hourly, basis to perform supply chain management functions in real time (EIL, 1994). Complex algorithms are utilized to maximize flexibility and control (LAN frame, 1997).

Manugistics Incorporated having impressive list of clients, created a SCM software (called Manugistics) in the planning engine applications (PEA) category. In particular, one of its clients AP Lockheed, a division of Automotive Products Plc in UK, has reengineered its supply chain to become one of the automotive sector's most efficient supply chains (Manugistics, 1998); they are one among UK's leading manufacturers and distributors of braking parts for cars and light commercial vehicles.

Traditionally, AP Lockheed's business processes had been manufacturing-driven. Over the last two years however, the company has effectively reengineered its supply chain and other operations to ensure that its core business processes are all market-driven. This has enabled it to respond more flexibly and rapidly to changing market requirements.

One of the main reasons for AP Lockheed's success is the implementation of Manugistic's Demand Planning supply chain management software modules. AP Lockheed was sharply aware that statistical forecasting was not very helpful, and that they needed almost real-time information about production plans and demand from their customers such as Land Rover (a world class manufacturer of sports utility vehicles and off-road four wheel-drive, rugged vehicles).

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By working closely with Land Rover's logistics operation, the company was able to create a high-level Demand Forecasting Unit (DFU) for each vehicle type. From this, a lower-level DFU was created for separate vehicle assemblies and part numbers, and a full set of parts for each vehicle was developed. Using the new "real-time" forecast, AP Lockheed could communicate customer and market requirements quickly and easily through all levels of the supply chain.

The benefits of the Manugistics software implementation exist at various levels (Manugistics, 1998). Overall inventory for key products has been reduced by approximately 25 per cent over the past few months—a cost savings that allowed the company to pay for the cost of the new system within 2 months.

The Manugistics implementation has provided other significant benefits to AP Lockheed as well. Before the reengineering effort, the Materials Control department used to spend about two hours a day at a part-number level checking to see if any exceptions had occurred that requires supplier action. After implementing the Manugistics software, it now takes only 15 minutes to fully review generated daily exceptions.

Manugistics has also allowed AP Lockheed to streamline parts delivery for customers such as Unipart. By changing from 'make-to-order' to 'finish-to-order' they have cut their lead times dramatically from 80 days to 28 days.

### **Internationalization of Supply Chains**

Another powerful trend in supply chain management is the trend towards global SCM, rather than national or regional SCM. A recent paper (Stevens, 1997) by KPMG Management Consulting reports on several factors that are driving European companies to manage their supply chain at a global level, rather than at a national level. Earlier surveys indicated that more than 50 per cent of all respondents managed their supply chain at a national level. The newer survey, on the other hand, reveals that national level SCM has fallen to just 26 per cent, while companies managing their supply chain at a global level has risen to 37 per cent. In fact, the newer report goes far enough to predict that global supply chains are "set to increase to 50 per cent of the total".

Several factors are driving companies in Europe (and other parts of the world) to re-engineer their supply chains. The most important reason is the need to compete effectively with organisations within the various nations within Europe itself. The EU Single market and the opening of the East to free trade have removed much of the previous barriers to the movement of goods, thus intensifying competition. In addition to European competitors, new entrants from all other parts of the world are also getting ready to take advantage of the liberalized market. In order to stay competitive, European organisations have little choice but to reengineer their previously national supply chain into a global supply chain.

Another situation that organisations face is the trend towards shorter product life cycles. Extremely rapid obsolescence, which is caused by perpetual "leap-frogging" by new competitor products, has major ramifications for the entire supply chain—from product design, manufacturing, supplier management, inventory management to customer relations. In the product design stage, for instance, proactive companies can develop a modular product design so that elements re-



quired to differentiate the product are added as late as possible in the supply chain. For example, the power supply module (110 volts or 220 volts), could be added as late as possible in the supply chain, depending on the requirements of the customer. This is amply borne by the situations posed by the Genesis project undertaken by PepsiCo (Stevens, 1997). In this, PepsiCo has put together a variety of cross-functional teams, which includes its own experts, as well as consultants from various US and European consultancy firms, to address various areas of its supply chain.

**Extremely rapid obsolescence, which is caused by perpetual "leap-frogging" by new competitor products, has major ramifications for the entire supply chain—from product design to customer relations.**

Many companies state that the major objectives of supply chain re-engineering are cost reduction and improved customer service. There is a perpetual 'inventory tension' that needs to be delicately balanced. The inventory tension occurs because there exists a trade-off between inventory levels, unit production costs (which includes the sum of manufacturing and distribution costs), and customer service. For instance, a tension exists where high levels of production and inventory might satisfy customer demands, but only at an unreasonable cost. If a balance between cost and customer service is to be achieved, it is imperative that market demand be translated into a feasible production plan throughout the supply chain.

Information technology plays a most crucial role in the supply chain re-engineering process. Supply chain management, at the global level (or to an equally important, but lesser extent at national levels) requires systems to analyze product flows, order patterns, and inventories across the globe. Techniques such as data warehousing, data mining, OLAP (On-line Analytical Processing), and decision support systems, along with extensive communications infrastructure (such as Intranets, Extranets, Internet, EDI) are needed.

Unfortunately, many existing systems, are not capable of achieving the above requirements. In fact, the KMPG report [Steven, 1997] states that almost 75 per cent of those surveyed identified obsolete information systems as the major obstacle to supply chain re-engineering success. The rigorous planning and implementation of information systems was more highly rated by 72 per cent of the respondents as a success

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factor than even planning for organisational change or physical infrastructure.

Implementation of new information systems resulting from supply chain re-engineering, as well as organisational transformation, is however, not entirely an objective exercise. Political and emotional factors cannot be ignored if success is desired. For global supply chain management, even the process of harmonizing product codes can be a formidable undertaking in the face of multi-language, multicultural, country focused personnel. Consensus decision making is rarely an option in such issues. A recent survey (Stevens, 1997) suggests that about 75 per cent of executives involved in supply chain re-engineering are preoccupied with people issues. Some significant issues include fear of change, loss of jobs, and loss of work independence.

## Conclusions

This is that re-engineering the supply chain results in significant cost savings, and enhances global competitiveness. Supply chain management software are currently capable of integrating the various existing software and business processes across departments within an organisation, as well as across different organisations. The entire supply-chain would behave as though it were one 'virtual' company.

One might rightly ask at this juncture whether the supply chain management introduces any new problems for the organisation. It has been already mentioned that 'people problems' might surface due to drastic changes in the way 'things get done'. Two other possible problems are the corruption of message contents and delay of messages due to computer system faults (Mathews, 1998). Since the whole organisation (along with all its business partners in the supply chain) is so dependent on the correct functioning of the system, a 'glitch' can result in serious consequences. Methods have to be devised to create fault tolerance, and fail safeness.

Finally, the security and functioning of the organisation can be compromised if hackers sabotage

the system or computer viruses destroy valuable data. In addition, there is the possibility of a virus being unwittingly (or otherwise) introduced into the system, and the chance that plain old bad data will cause a cascade of problems up or down the entire chain.

Legal problems (Mathews, 1998) are also possible due to uncertainty with regard to the validity and enforceability of messages, an inability to tell if messages were lost or being properly received, and other fraud concerns.

There are other, non-technical, problems, as well. As use of SCM, and increased efficiency, become more widespread, there may be a negative impact on labor markets (because current manual processes will be automated). And with the added move toward JIT, small company is seen as less "reliable" than bigger suppliers, or lacks the capital to invest in SCM systems.

Despite potential problems, the trend toward business process re-engineering using supply chain management software will continue. The pressure of competition and the need for efficient production methods is not likely to lessen, and the availability of SCM services on the Internet (when recent capacity problems have been resolved) will only cause this technology to expand. Future research must concentrate on eliminating or minimizing the drawbacks of supply chain management systems.

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# Planning for Re-engineering a Not-for-Profit Organisation: An Indian Case

S.N. Nandi and D.K. Banwet

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*The primary purpose of the paper is to establish that the BPR concept is highly relevant and desirable in government and other non-profit organisations too for ensuring greater efficiency and productivity. For implementing, there is partly a need for planned organisational change apart from active employee involvement. The present paper intends to provide a viable framework for achieving these goal. The concepts are illustrated with a typical case study of a not-for-profit organisation in the Government sector in India.*

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## Introduction

Developing countries like India have a large number of not-for-profit organisations, belonging to both Government and Non-governmental sectors, which have been providing valuable services to the society. Many of these organisations started with a considerable amount of vigour and commitment a few decades back. However, quite a few of these organisations seem to have lost considerable amount of momentum after successful working over a length of time. But some of these organisations are receiving a renewed emphasis in the light of changed socio-economic conditions. Because of insufficient attention which was paid during earlier years, management of these organisations are to change gear, rapidly rethink and need to improvise to a considerable extent.

The answer, perhaps lies in Business Process Re-engineering (BPR) which had been popularised in the beginning of the current decade, talks of fundamental rethinking, radical redesign of business processes, organisational changes etc. It is, therefore, quite prudent that such technique could be effectively applied to reinvigorate many of the not-for-profit organisations. However, there has been very little documented account of how such kind of organisations could be subjected to re-engineering.

Most of the literature (Bowman *et al.*, 1996; Thompson, 1997) highlight that the strategic issue for not-for-profit organisations relate to the prevalence of conflicting objectives; these organisations have many stakeholders, who provide funds and become dominant in managing such organisations, even though, fund givers are not necessarily the primary beneficiaries. As a result, many of these organisations find their management highly inward looking and primarily concerned with resource utilisation.

As a sequel to this, management of many of these organisations are short-term oriented and lack a strategic perspective. Efficiency oriented scientific management principles dominate the thinking of many of these managements.

BPR is of course a risky change initiative that even in the western country only achieve a limited success. Further, there is a considerable amount of difference of opinion whether organisations should plan a BPR initiative or not. Organisations face the choices—should they adopt a planned method or just-do-it (JDI) approach when implementing BPR. Many authors like Morris and Brandon (1993) say that re-engineering should be planned in the same way as done for information technology related changes. However, Hammer and Stanton (1995) claim that Re-engineering cannot be carefully planned like a traditional project.

In the case of a not-for-profit organisation, there is partly a need for a planned organisational change as it may require mobilisation of large amount of resources. However, there could be an element of employee involvement associated with an evolutionary approach to improvement. There is a need, therefore, for a flexible, but, comprehensive planning framework. The present article intends to provide the same.

**In the case of a not-for-profit organisation, there is partly a need for a planned organisational change as it may require mobilisation of large amount of resources.**

### Understanding BPR

There are many views about what is BPR. Majority accept the following two characteristics of BPR:

- Redesign of Business processes
- Improvement in Business performances to the order-of-magnitude

Hammer and Champy (1993) define BPR as "fundamental rethinking and radical design of a business process to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service and speed." However, the above definition is often taken in a context of operational performance improvement and, therefore, the expected gain in business performance does not happen. Even, in USA, Gene Hall *et al*, (1993) notes—"After months, even years, of careful redesign, companies achieve dramatic

improvements in individual processes only to watch overall results decline. By now, paradoxical outcomes of this kind have become almost commonplace. A computer company reengineers its finance department, reducing process costs by 34 per cent—yet operating income stalls. An insurer cuts claims processes time by 44 per cent—yet profits drop. Managers proclaim a 20 per cent cost reduction, a 50 per cent process-time reduction, a 25 per cent quality improvement—yet in the same period, business-unit costs increase and profits decline".

**After months, even years, of careful redesign, companies achieve dramatic improvements in individual processes only to watch overall results decline.**

According to Gene Hall *et al*, (1993) BPR differs from operational improvements in terms of both breadth/scope and depth of a process. BPR relates to an end-to-end cross functional process like new product developments, manufacturing, etc. which have higher span of influences. Any change made in respect of such processes invariably calls for changes in structure, skill, facilities, etc. in order to implement the redesigned process. Such kind of changes could then only be manifested in real time benefits to the external customers and other stakeholders.

Childe *et al*, (1994) have made distinction among several process-related initiatives. BPR has been shown to be much more strategic in terms of both scope and impacts as shown in Fig. 1. It has also been established that BPR is a strategic change process (Nandi and Banwet, 1997). It is in this context that BPR is termed as "Strategic Re-engineering" by Keh (1995) as it involves redesigning work to take advantage of higher educational level of workforces and enormous potentiality of information technology.

Boston University's Manufacturing Roundtable (Jeffrey *et al*, 1992) forum adopts an working definition of re-engineering as 'a radical or breakthrough change in a business process. Re-engineering process designs seek dramatic orders of magnitude, as distinguished from incremental improvement in business value'.

Based on the analysis of 23 projects, Dixon, *et al*, (1994) have observed that the radical nature of the change in the re-engineering is embodied in the change in improvement direction—rather than the change in the business *per se*. Not only must people do different

**'Re-engineering is a radical change in a business process. Re-engineering process designs seek dramatic orders of magnitude, as distinguished from incremental improvement in business value'.**

things but they must do them in an environment where the customary rules no longer apply. Major improvement was sought but more important is the direction of the goal to be changed. For example, time-to-market superseded product performance, flexibility replaced cost reduction as the objective considered to be most important in certain situations. In other words, the set of organisational improvement priorities need to change. It is believed that it is the demand for improvement along new dimensions that makes re-engineering both difficult and necessary. The newness of the improvement trajectory explains both the magnitude of the required change and the lack of an existing mechanism of achieving it. If the improvement was in a traditional direction, a degree of improvement required would be less dramatic and the organisation's continuous improvement processes would be adequate.

Over time, competitively successful firms learn how to improve in the directions their environments reward. Incremental innovations support the existing direction of improvement and do not disrupt the complex set of relationships among strategy, culture, technologies, workforce, policies and systems that are prevalent in the firm. When the environment changes and new competi-

tive priorities arise – whether because of the appearance of new competitors, technologies or other factors – the industry leaders are often slow to react.

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### BPR Planning

Herein an innovative alternative to carry out value adding tasks with a different set of strategic priorities is called for. A business unit organises its various elements consciously or unconsciously with a pre-conceived set of priorities. For example, a typical Indian business firm holds cost minimisation as its primary strategic priority which is manifested in the functional organisation structure of the firm and the leadership style of its managers who are selected and retained by the firm. Similarly, many of the Government owned service organisations display their top most concern on compliance to a set of pre-defined rules and procedures as manifested in the structure of the organisations as well as by the working style of their officials and reward and recognition policies. Business Process Re-engineering (BPR), in such a kind of situation thus, calls for following actions:

- Review of organisational objectives in the light of emerging socio-political, cultural, technologi-

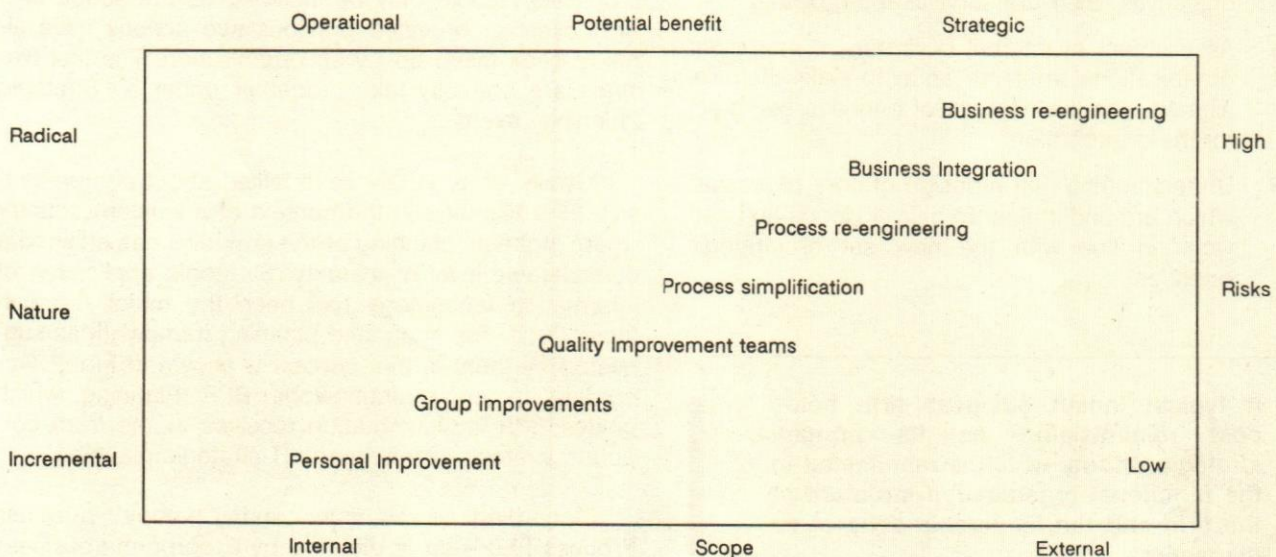


Fig. 1. Comparison of Various Process Initiatives (Childe *et al*, 1994)

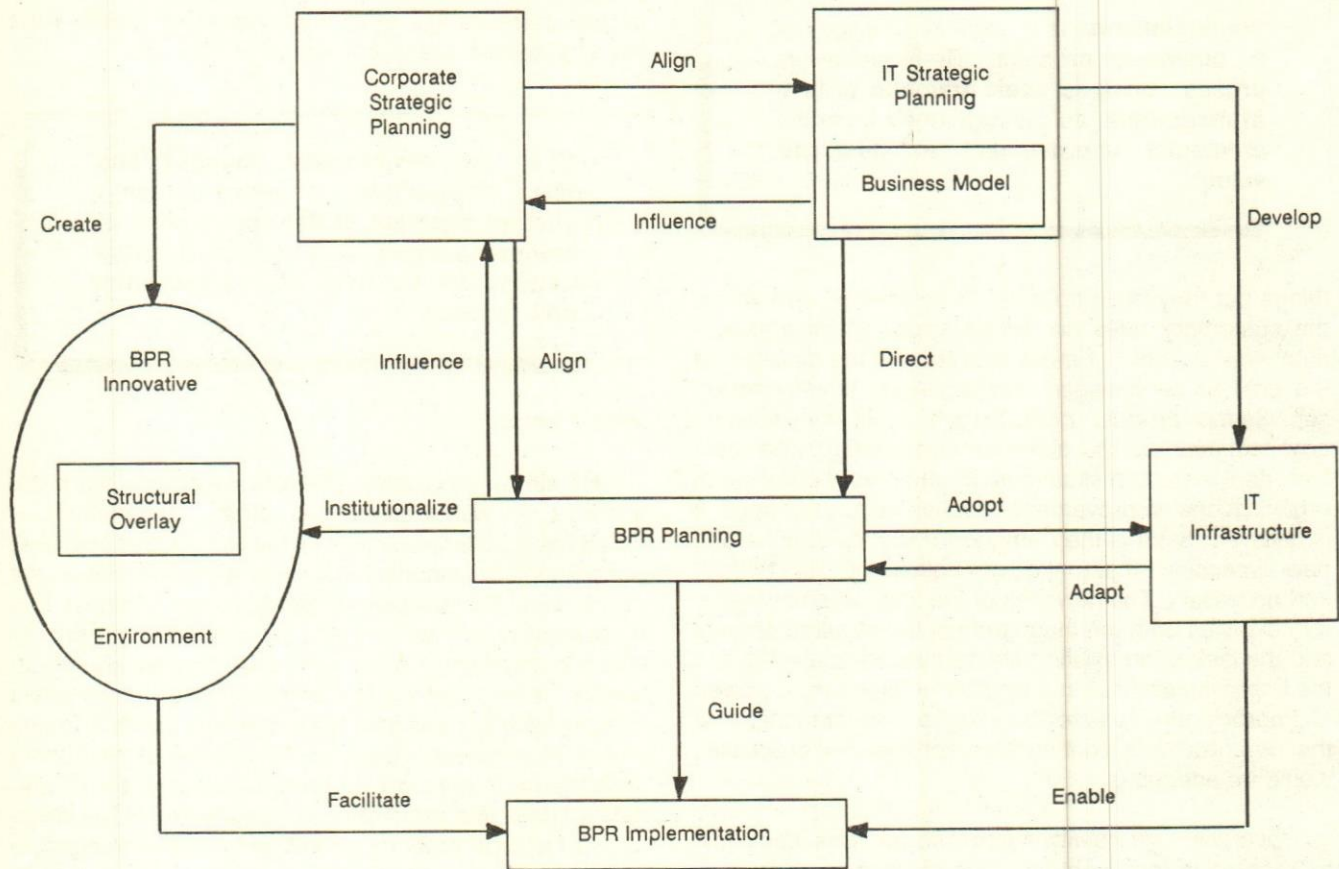


Fig. 2. An Integrated Planning Framework by Grover *et al*, 1993

cal and economical environment, resulting in genuine understanding of the different set of objectives to ensure survival and growth.

- Assessment of internal environment and other organisational artefacts, so as to make them realigned with the new set of priorities being set for the organisation.
- Understanding and redesign of core processes which are undertaken to deliver goods and services in line with the new set of strategic priorities.

**A typical Indian business firm holds cost minimisation as its primary strategic priority which is manifested in the functional organisation structure of the firm and the leadership style of its managers.**

The third item in the above agenda, which is normally termed as "re-configuration or restructuring of processes" could only be included as the scope of a BPR exercise provided previous two actions have already been taken up by an organisation. The first two items are normally taken together under a "Strategic Planning" exercise.

Grover *et al*, (1993) have talked about comprehensive BPR Planning in the context of a western country where strategic planning at the firm level has attained a considerable level of maturity. Strategic application of information technology has been the major issue in those firms. The integrated planning framework as suggested by them in that context is shown in Fig. 2. According to above framework, BPR Planning which guides BPR implementation receives inputs from corporate strategic planning and IT strategic planning.

According to Hammer and Champy, Business Process Redesign is dictated by a corporate/business strategy which is shaped or reshaped by various environmental forces including changes in customer

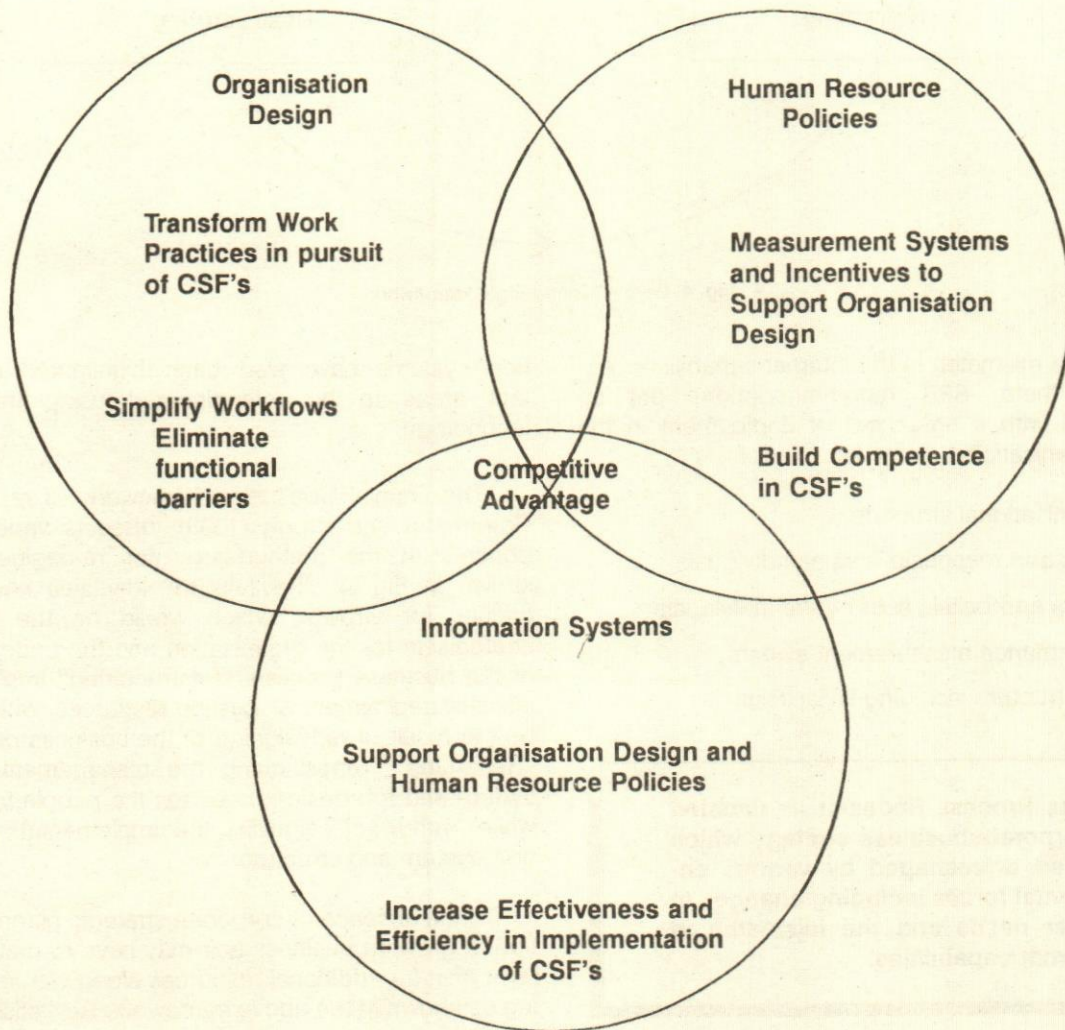
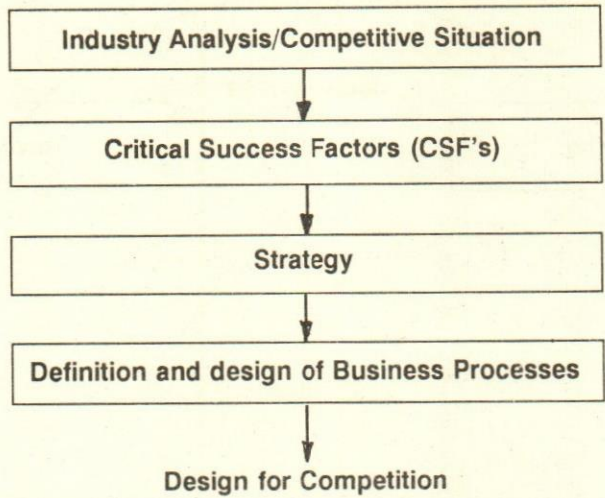


Fig. 3. Strategic Re-engineering Framework (Schnitt, 1993)

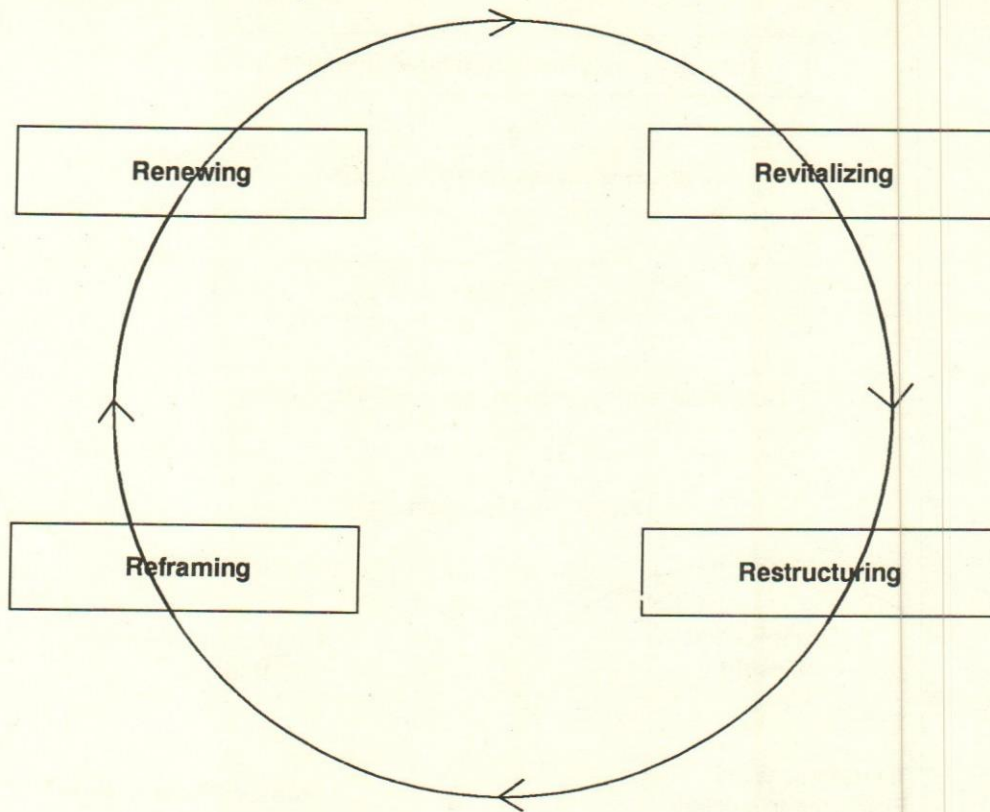


Fig. 4. Gemini Consulting's Framework

needs and the mismatch in the internal capabilities. According to them, BPR recommendations get institutionalised with a right kind of deployment in the following organisational elements:

- Organisational structure
- Roles and responsibilities of individuals
- Values and beliefs held by the individuals
- Performance measurement system
- Infrastructure including IT facilities

**Business Process Redesign is dictated by a corporate/business strategy which is shaped or reshaped by various environmental forces including changes in customer needs and the mismatch in the internal capabilities.**

In strategic re-engineering, (Schnitt, 1993), the use of critical success factors are emphasized as shown in Fig. 3, in order to formulate strategic priorities. Informa-

tion systems have also been highlighted as important areas to be re-engineered using information technology.

The Gemini Consulting framework as reported by Gatermann and Krogh (1993), dissects various components in the methodology for re-engineering as shown in Fig. 4. "Revitalising" Identifies new opportunities for Growth, which would be the result of strategising for the organisation and the understanding of the business process. "Restructuring" implies more efficient deployment of existing resources, which would be the result of redesigning of the business processes. "Reframing", repositioning the management system, culture and job design mobilises the people for action, while "renewing" signifies the implementation of the new system and structure.

In the absence of corporate strategic planning tradition, a growing business unit may have to make a long term plan for additional resources along with restructuring as shown in the above framework. Revitalising in the above framework needs to be looked into not only from shareholders' point of view, but also from that of other stakeholders, like employees and societal ones. In this context, Tinaikar (1995) has defined BPR as "the



reconstruction of organisational processes through a mutually integrated effort by various organisational coalitions to achieve and maintain negotiated improvements". A model for comprehensive planning of BPR in an organisation where an effective strategic planning is not in place, has been developed based on a synthesis of models—Mckinsey's 7S (1977), Leavitt's (1965) Model, Scott Motton's MIT 90 framework (1991), Stohr and Konsynski (1992) model and a social perspective of BPR proposed by Tinaikar (1995). The proposed framework has following components—

- Revitalizing
- Reframing
- Retooling
- Restructuring
- Renewing

**In the absence of corporate strategic planning tradition, a growing business unit may have to make a long term plan for additional resources alongwith restructuring as shown in the above framework.**

Each of the above components along with its principal constituents with a help of what is being done for a typical not-for-profit organisation are illustrated.

#### **BPR In a Quasi-Government Organisation (QGO): A Case Application**

The comprehensive planning framework described above has been applied to a Quasi-Government Organisation (Coded as QGO, to conceal its identity) which is providing some kind of techno-judicial services to high-tech industries and the scientific community. QGO, started nearly 100 years ago is presently working as a subsidiary organisation directly under a Ministry. It has four offices, one each in the four metropolises. It has a Chief Executive reporting to the ministry and is responsible for the efficient working of the organisation. There is an advisory board comprising of members drawn from industry, scientific community and the relevant Government ministries. However, the concerned ministry provides total budgetary support to the organisation. It has a total strength of about 300 employees consisting of around 60 professional staff and the remaining, support staff.

The organisation receives applications mostly through the representatives of the end-users and processes them before it delivers the service to the customers. The set of activities include:

- Scrutiny of an application so as to ensure that the applicant provides all the necessary information.
- Examination of the claims made in the application.
- Entry of the claim, if established, in a national repository document.

Out of all the above mentioned activities, the activity of claim examinations is technologically the most difficult job which is always done by the professional staff members. The first and the last activities are mostly carried out by the supporting staff. At present, the whole set of activities is carried out in a sequential manner involving a large number of work centers manned by either professional staff or supporting staff members. QGO has a limited capacity due to the shortage of staff members and the existing method of working.

Scientific community and the high-tech industries, especially those owned by the multi-national firms are greatly dissatisfied with their services as they find each of their applications taking around 5 to 6 years for complete processing. Such customers also find that this organisation lacks flexibility in regard to working hours, applicant formats, and query processing. Ministry officials have also been, of late, worried about the state of affairs as the enhancement of the capacity and the capability of QGO is one of the important imperatives for enlarging international cooperation. Hence, a re-engineering plan for QGO has been worked out.

QGO is a techno-judiciary Government organisation. Its administrative structure and working style fit more the "machine bureaucracy" model in the language of Mintzberg (1979). It treats outsiders more as "citizens" rather than customers. It values integrity and impartiality much more than the delivered quality of services. Such kind of organisation located in most of the developed countries works in a highly automated environment with customer friendly interfaces. Multi-national organisations who are familiar with such services do expect considerable improvements in the services from the Indian counterpart.

From the above scenario, it could be easily observed that the strategic priority of this organisation needs to undergo changes. It should be concerned as much with the quality of services as with the proper compliance with the rules and regulations. The existing

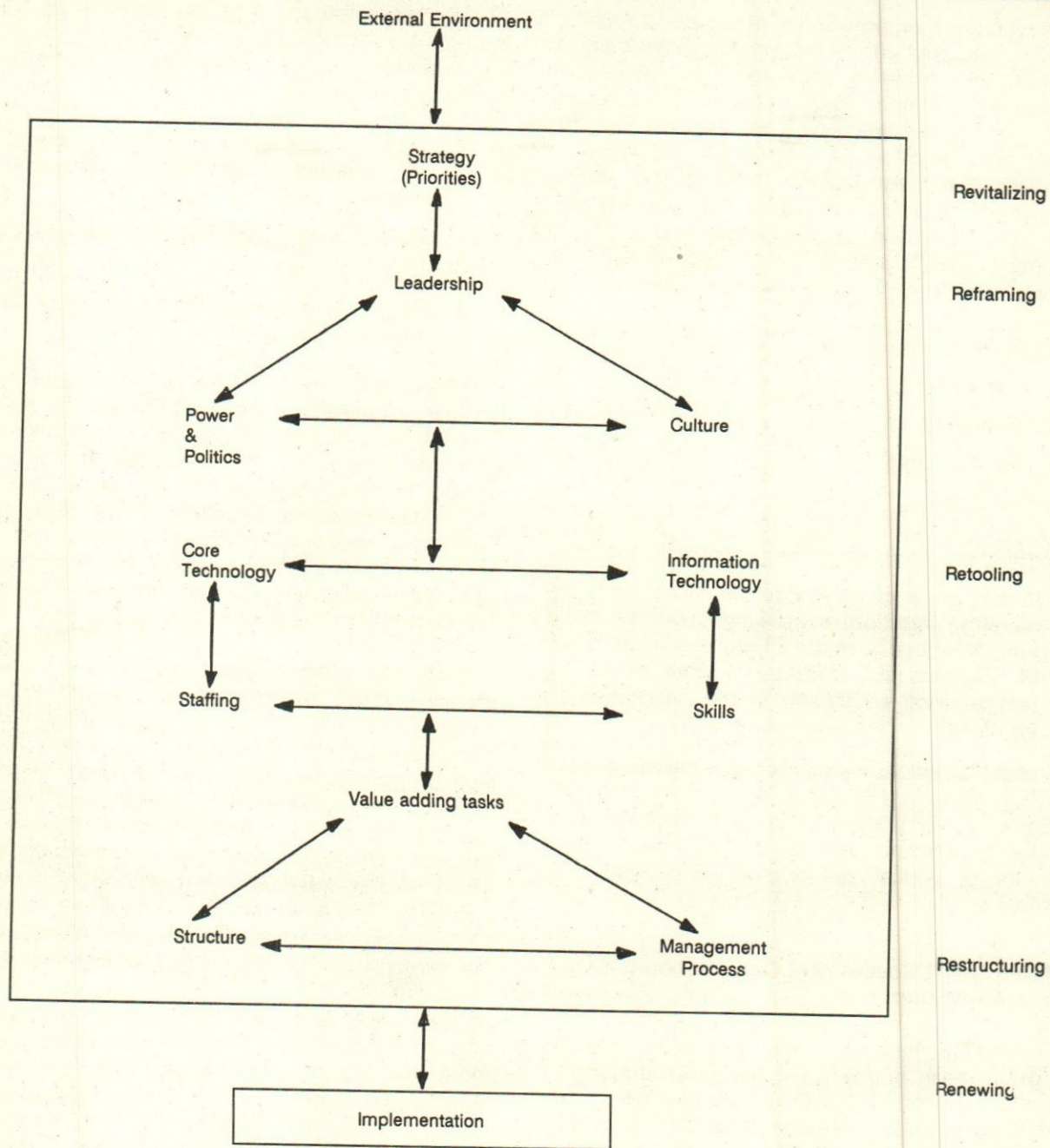


Fig. 5. Proposed BPR Planning Framework

source of its funding needs to be also re-looked into. All these observations do point out that the organisation needs to establish a new set of strategic priorities and, thus, justifying the case for Business Process Re-engineering (BPR).

With the initiative of the Ministry, the entire planning for QGO has been done as a joint exercise between consultants—Indian and foreign ones and a selected

number of middle ranking professional staff members. The selected professional members included in the planning are those with necessary technological qualifications and long experiences and displaying a considerable amount of interest for initiating changes. The planning exercise took about 8 to 9 months with both ups and downs in terms of group dynamics. However, a workable solution was finally developed and is presented below.

## Action Planning for BPR

Observations and actions planned to be initiated in respect of each of the components for the proposed model are mentioned below:

### Revitalisation

QGO is facing a tremendous environmental pressure to reorient itself. Senior professionals who are presently at the helm of the affairs are highly technically qualified but have not yet prepared an explicit blue print of the organisation for the future. They are too much involved in day-to-day activities. They have never been subjected to any systematic thinking session where they could examine the pros and cons of their organisation as a whole and its future challenges. In order to evolve a future picture, SWOT (Strengths, Weaknesses, Opportunities and Threats) sessions were conducted among them. In fact, there were two levels for which the above sessions were conducted. One was organised among the senior and top level professional and the second one among younger professionals. A few outside resource persons drawn from customer representatives, retired professionals and the Ministry officials were involved to provide inputs about the possible role of the organisation in the future.

**Senior professionals who are presently at the helm of the affairs are highly technically qualified persons but have not yet prepared an explicit blue print of the organisation for the future.**

Strangely, it was found out that many of the professional staff members made comments about the usefulness of SWOT sessions in their organisation. But many of them got impressed when quantification was made in terms of organisational performance measures. Time taken to deliver a service and the convenience to be felt by the customers in submitting applications came out as the topmost priority goals in the emerging situation in contrast to the present emphasis in terms of number of applications processed by the staff members.

In order to create strategic awareness especially among the senior staff members it was felt that following actions might be necessary in future:

- A short general management course to be organised for senior professionals.

- A benchmarking visit to be made by a group of selected senior professional to a similar office located in a developed country.
- A steering group is to be formed who will be made responsible for overseeing the implementation of re-engineering in the organisation.
- Senior executives will be required to speak about vision and mission of the organisation in future training programmes and other kinds of meetings to be held for younger professionals staff and even for supporting staff members.

**Time taken to deliver a service and the convenience to be felt by the customers in submitting applications came out as the topmost priority goals in the emerging situation.**

### Reframing

#### Leadership

Both middle and top levels of professional staff members have so far displayed transactional leadership rather than any indication of transformational leadership. However, some of the middle level officers have been mildly persuading top levels for making major changes in the working. A self-assessment questionnaire was administered to find out the existing profile of leadership and the work climate. The profile emerged clearly establishes that the prevalent situation is not conducive to have a self-sustaining re-engineering programme in the organisation. It has, therefore, been decided that some of the following actions may be necessary to make the organisations accept changes:

- (a) Two new groups—Human Resource Development and Information Technology will be created in the organisation. They will pave the way for creating a climate for changes.
- (b) A training programme especially in relation to management of science and technology institutions is to be organised.
- (c) Restructuring of tasks which is the core element in the BPR will be undertaken on incremental basis. Employees at different levels will be involved on project basis. A case for such a kind of 'Incremental Re-engineering' in an Indian organisation has been recently made by Rastogi (1997).

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## Organisational Culture

It is Davenport (1993) who highlighted the importance of qualifying the culture and politics of business processes since culture and related corporate realities interact to influence performance. An organisation needs to be aware of the shared perceptions and examine if these perceptions are consistent with objectives, strategies and tasks to be undertaken by the people at different levels. Culture is a highly messy term. It denotes shared philosophy, values, beliefs, attitudes and behavioral norms that are displayed by organisational members. According to Schein (1985), culture manifests itself at three fundamental levels. At the observable level are the behavioral attitudes, norms and other artefacts; underneath artefacts lie values and underlying the values at the core are basic assumptions.

**An organisation needs to be aware of the shared perceptions and examine if these perceptions are consistent with objectives, strategies and tasks to be undertaken at different levels.**

In order to assess broadly the kind of culture presently existing in the organisation, consultants observed the attitude being displayed by the senior members and categorized them. As per the classification system proposed by Quinn and McGrath (1985), the prevalent culture could be identified as "Hierarchy culture" where the senior officials are mostly internally oriented and expect others conforming to their ways of doing the work. Such kind of culture can also be defined as "Process culture", according to the classification suggested by Deal and Kennedy (1990). Revenaugh (1994) argues that such cultural environment makes any change to be made on a process a very difficult proposition. In fact, it takes a great effort just to get the BPR plan discussed. This has also been found to be partly true as per the experiences of the consultants involved in the project.

It has been further observed that employees especially of professional and supervisory levels have strong disposition about their special role in the society. Integrity, impartiality and the special skill are valued strongly in the organisation. Prevalence of such strong values and belief systems make the change in the management difficult.

As mentioned earlier, customer service is going to be the dominant item under re-engineering situation.

Some of the following actions which could help the organisation inculcating new values in the direction are given below:

- Conduct management development and employee development programmes with emphasis on customer service.
- A vigorous documentation should be prepared in respect of proposed responsibility profile and the working systems which will be evolved as a result of re-engineering.
- Benchmarking visit should also be organised for a number of opinion makers.

## Power & Politics

There are three dominant groups who wield considerable amount of power to influence. Concerned officials in the Government possess enormous power because of system and resource allocation responsibilities. Supporting staff have a strong Trade union to make their points of opinion heard. They have a strong influence in detailed working, termed as 'Process' in the organisation. Though professional staff do have a professional association, such body does not have directly any major influence in the organisation.

The planning process has been carried out in such a way that the hands of pro-changers are strengthened. A detailed communication plan has also been envisaged so as to build up an appropriate atmosphere. Some compromises have also been made in a few areas especially ones related to human resources planning.

## Re-tooling

### Core Technology

The core technology for the whole service relates to documents searching when documents are kept in CD-ROM media. Therefore, it is the information technology which has become a part of core technology. There is another aspect in relation to core technology. Scientific disciplines have proliferated to a large range. But the organisation has professional staff having knowledge only in limited number of areas. It has, therefore, been suggested that there should be an adequate coverage in terms of scientific and technological disciplines.

### Staffing

The existing strength of professional staff is highly inadequate to cope with the enhanced level of service. So, there is a need to have additional staff strength in

relevant areas.

### Information Technology

The service of organisation is totally information intensive. According to classification system developed by Earl (1989), such service is going to be absolutely dependent on information technology for acquiring a global image.

However, the present stage of IT in the organisation QGO is at a rudimentary state. There is a small centralized IT Section where professional staff members use IT facility consisting of a few personal computers with CD-ROM drive to do referencing work on the documents which are available. There has been hardly any other use of IT in this organisation. According to Nolan's stage theory, (1976) the present IT application is at Stage-One. It is therefore quite challenging to transform the present IT status to a stage where all the activities involved in the delivery of services will be done through a networked structure. In order to transform the situation, it has been suggested that IT facility should be inducted in phases, however, with a vision of having an world class technology at the end.

### Skill

It is of course the most essential that both professional and supporting staff have to acquire adequate IT skill. There is a sizeable group of people in QGO among the supporting support who are comparatively younger in age and have keen interest in learning IT-related skills. It is therefore, suggested that following practices could help in enhancing the skill of the employees:

- Each staff member should be trained on IT.
- Certain amount of flexibility will be provided for the staff members to keep on using IT facility for various activities of their interest.
- People will be involved in developing the computer application within a broad framework of a future vision.

### Restructuring

#### Value-adding tasks/Processes

Presently, applications in prescribed form are submitted in multiple number of hard copies along with requisite fees by the customers or their representatives. Applications are first scrutinized by various support staff members. These applications are then sorted out and assigned to appropriate professional staff members. Technical examinations are made by the professional staff

based on which claims are accepted or refused. In case claims are rightly established, certain benefits are conferred on the applicants. The present way of carrying out the end-to-end core process is going to cause dissatisfaction to the future customers in the following ways:

- People would prefer submitting applications on a floppy.
- Time to be taken should be in days rather than months.
- Status should be made known, when asked.
- Any enquiry, if required, must be made once.
- Benefits are undisputable.

On examination, most of the sub-processes are found to involve structured decision making and so are easy to be computerised. Technical examination being done by the professional staff needs accessibility to a specialised global network. Many of the similar kinds of service organisations in developed countries are more or less working with such a kind of IT intensive process environment.

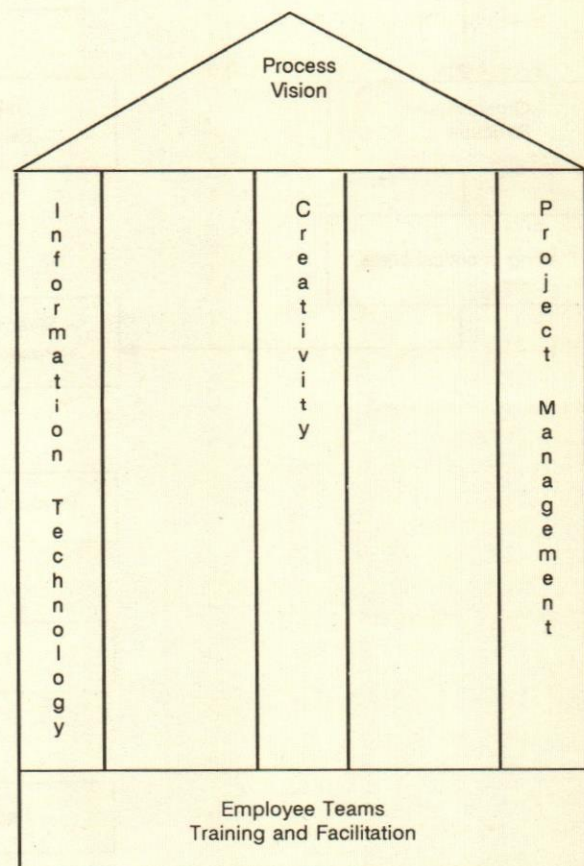


Fig. 6. Proposed Approach for Re-engineering

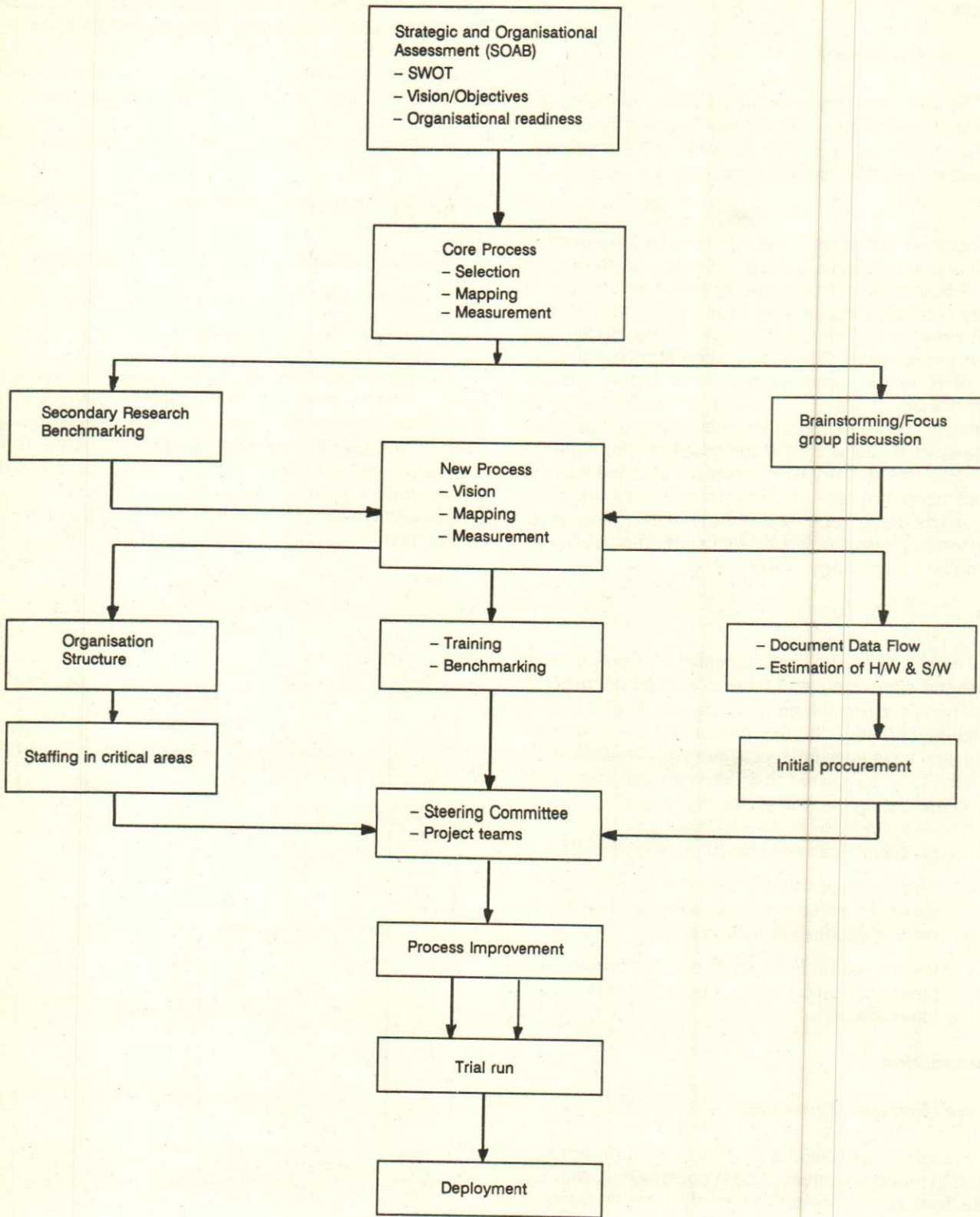


Fig. 7. A Proposed Implementation Plan for BPR Application

Given the existing level of IT-skill and facilities and the interest of various stakeholders, it has been considered prudent to move towards the above process vision in phases (incremental re-engineering). Both professional and staff members with the necessary training at various stage will be made to work in teams on process improvements over years as shown in Fig. 6.

### Structure

The existing organisation is highly hierarchical-5 levels among professional staff members and 4 levels among supportive staff members. Professional staff members, belonging to more or less same science and technology discipline, carry out all the functions—personnel, marketing, financial besides core ones. Such an organisation, sometimes referred as 'Machine organisation', (Mintzberg, 1979), will not be effective with the increased complexity of tasks arising out of introduction of Information Technology (IT) and a need for developing an innovative environment. A professional organisational structure with dedicated IT and HRD groups has, therefore, been suggested.

At operational level, a front group is to be formed to receive and sort out applications. There will be several specialised groups, each group, consisting of a number of professional and supporting staff members, to be empowered to make all the necessary decisions for completing the processing of an application.

### Management Processes

Communication, Rewards & Recognition-Systems, Performance Measurement and Recruitment & Selection of Personnel are the means by which a net set of strategic objectives are reinforced. (Olian, *et al*, 1991). Appropriate actions have, therefore, been suggested.

### An Integrated Implementation Plan

There are several action items which have been identified in various areas as mentioned above. Some of the action items would be combined under one change initiative. Even, then, there is a number of initiatives which are required to be undertaken to re-engineer the organisation. A comprehensive implementation plan indicating various change initiatives and their inter-linkages have been prepared and shown in Fig. 7.

The above implementation plan includes broadly following three categories of actions:

1. Preparatory activities through which an innovative environment will be created.

2. Mobilisation of resources in terms of hardware, software and human resources to be deployed.
3. Conduct of several process improvement projects so as to realise the proposed vision on incremental basis.

The above implementation plan has been debated at various levels. It is believed that it will be very soon put into practices and that will provide further sources of learning.

### Conclusions

This article establishes that Business Process Re-engineering (BPR) involves strategic re-positioning and break through changes in core processes. Such an approach is absolutely necessary for a not-for-profit organisation in a developing country, where the concerned management is not strategic-minded. The case for one such organisation has been highlighted in this paper.

A comprehensive planning framework has been evolved to re-engineer a typical Indian organisation where strategic re-positioning has become necessary with the advent of economic liberalisation. The above framework involves a complete strategic analysis of all the organisational issues like strategy, structure, systems, technology, culture, etc. It is hoped that the further work will refine the proposed framework.

### Acknowledgment

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*Re-engineering focuses every objective on one area rather than allowing companies to have distributed objectives.*

— Ganesh Natarajan



# Business Process Re-engineering Through Enterprise Resource Planning – Some Insights

A.P. Kastuar

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*All business organisations like living things have similiar variations and decay. Consequently there is a need to re-engineer business processes. The present paper stresses the vital role of Enterprises Resource Planning (ERP) as an essential policy instrument to achieve Business Process Re-engineering (BPR) effectively and efficiently. Basically ERP harps around the tools of information systems and information technologies. However, the author cautions that effective ERP implementation for BPR should be a business initiative and not a traditionally supposed IT initiative. Finally it is pointed out how ERP has been incorporated in several sectors of Indian industry.*

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## Introduction

Business Process Re-engineering (BPR) has been one of the most well-known and useful tool among management, information and resource planning consultants. Of course, engineering or re-engineering of business processes has been in vogue since ages. However, the business process, procedures and information system do decay and thus there is need to 're-engineer'. Basically it brings about significant changes in basic business process to improve efficiency in performance of the organisation. With the growth of education, science and technology, the above has transformed from the skills of individuals to a scientific way of carrying out engineering or re-engineering. With the rapid growth of Information and communication technology, the recent trend in the world has been to link BPR with Information Systems and Information Technology Solutions. The advent of the Enterprise Resource Planning (ERP) has given it a different dimension altogether and has brought about revolutionary changes.

Many have described re-engineering as a fundamental, radical, dramatic business process change. It is totally different from the earlier concepts and tools viz., TQM, KAIZEN, JURAN, Quality Circles etc. Enterprise Business Re-engineering demands essential ingredients for the successful companies of the year 2000 and beyond. The ultimate aim is to re-engineer all value streams of the enterprise. Value stream is a collection of all work that delivers value and satisfaction to each of the customers of the enterprise. The goal is to achieve all the possible dramatic improvements in quality, service, speed and cost.

Business Re-engineering within the frame work for Enterprise Change is the means by which major, cross-

functional components of the enterprise are re-engineered. There are several phases of re-engineering such as bringing radical changes in the sales and delivery mechanism to increase the sales, reducing the cycle time to process the order or introduce new manufacturing facilities, methods that delivery more productivity per employee, etc.

The present paper as a practical guide, envisages ERP implementation for successful BPR management.

### Relevance of ERP Package for BPR

There is the need to understand as to when it is appropriate to re-engineer and the to implement the Business Process Re-engineering Projects. The emerging competition, global economic factors and the progress of the technology are throwing tougher than ever challenges before the organisations. The challenges manifest themselves in situations such as:

- processes need to be more effective
- improved processes and customer satisfaction
- world class performance
- survival under fierce global competition

**There is the need to understand as to when it is appropriate to re-engineer and the to implement the Business Process Re-engineering Projects.**

Prior to embarking on a BPR project there are few points:

1. The need to understand the barriers to overcome in *Re-engineering* and why many companies do not engage it even if it means survival. Failure to learn from experience and lack of understanding of the customer activity life cycle create the kind of *barriers* which are difficult to break.
2. It is essential to know how the enterprise manages the change due to introduction of BPR. Changes in the market and the business environment is the key to the need of Business Process Re-engineering.
3. Company often fails to achieve the breakthrough when it focuses only at certain business areas of its processes at the expense of

**ERP implementation is typically user-driven based on the re-engineering approaches and will usually drive greater and radical changes than any system developed the traditional way.**

others, such as focusing at order processing, sales credit, production or distributions individually or in piece-meals. Also the computer systems built independently for each business department or business areas only reinforces the walls between them. Business Re-engineering demands that companies dismantle the walls between the business areas. To dismantle the walls more effectively, the new procedures evolved must be based on the simplicity of design around today's computers and communications technology. This is where the ERP has become an effective means of business process re-engineering. ERP demands viewing all the business areas together and also demands new processes, one that takes far more resources from Users greater than ever before. ERP implementation is typically user-driven based on the re-engineering approaches and will usually drive greater and radical changes than any system developed the traditional way. It also costs a great deal and the projects may be delayed or even may fail if the factors for making the right selection of the ERP package and the Ingredients of the recipe for successful implementation of ERP are not correctly understood and focused at.

### Selection of ERP Package

In the present era, when increasingly more and more organisations are looking to implement ERP, the competitive advantage would lie with those having the abilities to address the various critical success factors highlighted previously in the form of 'cautions' before embarking an ERP implementation. However, understanding the critical success factors alone is not sufficient. The ability to successfully implement ERP becomes a critical skill, a new and distinct competency; This begins with skills for correct selection of ERP package. A good package can change the nature of re-engineering processes in several ways. It can provide based on the best practices, a complete integrated system unifying all the process areas it makes available. As a matter of course in many of the improvements that the Company identifies in the process of re-engineering, IT

serves as a technology enabler for the implementation team to specify how it wants to organise and run the business in an integrated way at a detailed level. A good ERP package in fact knits and triggers the action for the whole organisation.

Selection of ERP package varies from organisation to organisation and situation to situation. The decision could be based on purely technical evaluation or techno-commercial evaluation and some may go on the basis of only commercial evaluation. It is for the organisation to decide the course. Here are however some of the suggestions for making the right selection:

**Selection of ERP package varies from organisation to organisation and situation to situation. The decision could be based on purely technical evaluation or techno-commercial evaluation and some may go on the basis of only commercial evaluation.**

1. Address and document the following key questions:
  - Why is the package being implemented?
  - What business objectives or results are to be achieved?
  - What factors are important to the business and technical organisations?
  - What is the over-all business and technical scope to be addressed by the package?
  - What existing factors/environments could constrain or govern the selection?
  - What are the inherent business and technical risks in implementing and using the package?
  - What is/could be the cost to the organisation from a wrong decision?

2. For selecting the appropriate ERP package, begin with short-listing on the ERP packages based on the international experience (if any), scanning of technical literatures, journals and publications on various ERP solutions and input from Consultants and experts.
3. Next would be to study, compare and evaluate the technical features, potential and suitability to the organisation: in terms of the business, technical, and vendor requirements that are supported; in terms of the package's approach or method of implementing the requirements; in terms of the degree of business processes and technical changes required to implement and use the package. This must bring down the number of the short-listed ERP vendors even further.
4. Then find out the vendor's direction, policies, and services (pre-sales, during the implementation and the post-implementation support). As the ERP packages are expected to take the organisation to year 2000 and beyond, the ability of the vendor to provide software upgrades to meet the ever changing business and the technology demands is also a crucial factor.
5. Check on the availability of the third party services as well as the Implementation, upgrade, deployment and operation costs of each ERP package.

#### Recipe for Success in ERP Implementation

Many firms have successfully executed ERP implementation and reported manifold return on investments. At the same time there are organisations who have failed to even to go live with ERP systems and in the process are frustrated and totally at loss as to 'How to move forward'. Therefore, we need to have a careful look

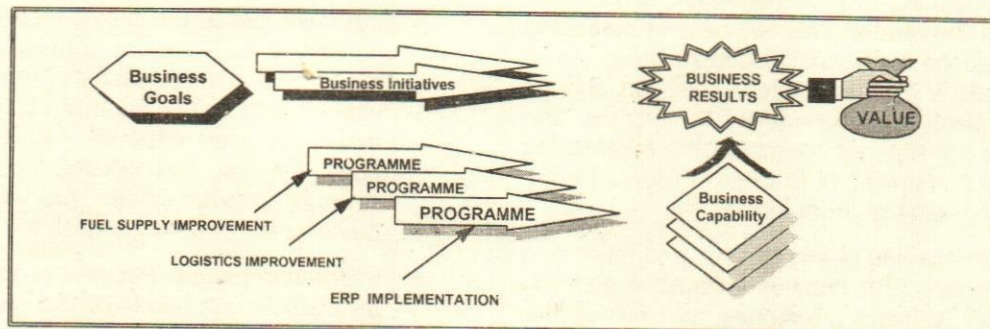


Fig. 1. Schematic diagram of ERP as a corporate strategic tool for achieving Business Objective

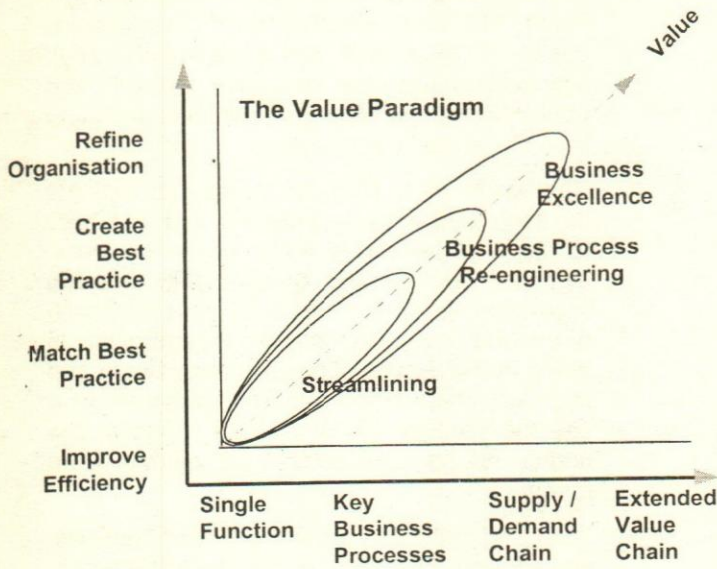


Fig. 2. Value Paradigm Shifts

at the recipe for the success in ERP. The key factors to be looked into for successful ERP implementation are enumerated below:

- Positioning the ERP implementation for BPR as a business initiative and not an IT initiative (Fig. 1).
- Understanding and appreciation for the organisations corporate culture.
- "Understanding the readiness of the organisation to change and the appreciation of the capability to make the change and the capacity to change the mind set" is extremely important. This brings to the fore the issues of paradigm shift and a "value paradigm" in the organisation (Fig. 2).
- Communicating and communicating at all levels to inform, educate for realistic setting of expectations and above all to seek commitment and involvement from top management to the lower most in the ladder. This will help in managing expectations and avoiding people being upset, frustrated and disappointed. This can change the mindset from "cannot do" to "can do" and provide the superior championship by ensuring that the champions of Business Process Re-engineering, emerge from inside.
- The management of any Project, and more so a BPR through ERP, requires exhaustive planning of activities, major milestones, mini milestones, computation of the resources required in terms of the three "M's" (Man, Material and Money)
- etc. The most important of all is the Project Management skill which is very distinctive and individualistic. Therefore, selection of Architect and Leader, the right person to lead the project becomes a vital critical success factor. This is different from selecting a project manager. The architect has to ensure that the project is not merely done within the budgeted time and more without sacrificing the quality, but that also meets the larger and broader objectives. He should be able to conceptualize and draw a road map and then be able to ensure the organisation navigates successfully through as per the road map drawn.
- Innovative and empowered project team—The selection of the Project team members is no less important. In a project like BPR through ERP implementation, the ability to conceptualize and innovate plays a vital role in coming out with new systems and solutions to meet the future challenges of the organisation. The empowering of the team members to take decisions goes a long way in eliminating delays and over-runs of time budget. Placing mere functional team such as Finance, Materials is not adequate; skillful formation of cross-functional teams is equally important to ensure correct integration.
- No short-cuts to Testing of new process and in End-user training. Often, just as in construction of houses and buildings one tends to start running out of time, patience and money and compromises with the finishing touch. So is the case in ERP implementation where the people towards the end, after having customized the ERP package, show impatience to go live and this is often done at the expense of testing of the new processes and adequate training to end-users. It is strongly recommended that there should be no shortcut to testing and it must be treated with a great deal of importance. The end-user training should be viewed from the point that a tool is as effective as the users could use it. Therefore, arming the users with information and experience through extensive user-training (a minimum of 80 to 150 working hours per user) depending on the ERP packages and the complexities of the system is strongly recommended. This will be just adequate to start and not exploit the new system.
- Integrating people. People integrate system. Individualistic approach of the various sub-systems consisting the project team is one which must be guarded against, e.g., one could have

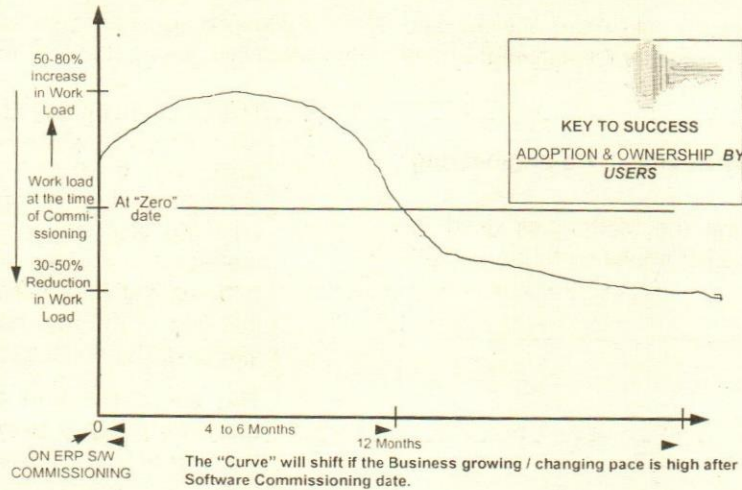


Fig. 3. Dynamics of ERP Software Stabilisation

sub-project teams—one for finance, another for materials, another for logistics etc. working individually and there is no professional inter-mingling of the project team members—it could lead to poorly, inadequately integrated implementation of the system. Therefore, by integrating the people in their mind, in their thoughts, building a team spirit is extremely important, one could be assured of a well integrated system.

- Identifying local constraints. These constraints could be geographical, locational, social, political etc. These could have impact on the feasibility of having the right IT and Communication infrastructure in terms of LAN, WAN etc. as well as by way of ability to attract right talent.
- Changing over to new information system specially after ERP implementation, calls for massive data transition. The complexities of the *data transition* depends on many factors such as computerized systems existing before ERP implementation. It is complex even if there were no computerized system prior to ERP implementation. The data transition must be given due importance and should be treated as a project within the project, if one has to ensure success of the ERP implementation. The legacy data moved to ERP data base must be clean, correct and up-to-date. Here the role of in-house IT team is extremely important to provide right technical solution for migration of data to legacy data system to new systems. Active participation of users in identifying the data to be moved; cleaning of data is even more important. The whole exercise could be very complex if not properly addressed to.

**Changing over to new information system specially after ERP implementation, calls for massive data transition. The complexities of the *data transition* depends on many factors such as computerized systems existing before ERP implementation.**

- Generally implementing information systems is understood by most as going *live* with the system. Truly this can at best be called commissioning of the system. Implementation of ERP package would be truly complete only when its usage reaches the desired level and the users are able to fully exploit its potentials. Therefore, it is extremely important to have an appreciation and understanding for the post-implementation scenario or specifically post-commissioning scenario. Adequate precautions must be taken to ensure the availability of correct multi-functional team to support the end users for the required length of time which could vary from 3 to 6 months, for ensuring the right kind of support to the end users.
- Typically in going *live* to the new system and more so with information system, there is a constant increase in the work load of individuals in the organisation (Fig. 3).

Therefore, it is extremely important for the top management, middle management and the end users and the project team that they must appreciate the dynamics of commissioning of software and its sub-

sequent stabilization or else it could bring unwarranted frustrations, frayed tempers and spoil what might have been a wonderful job.

### Techniques in ERP-Driven Business Re-engineering

Following are the some the techniques used for successfully completing a ERP implementation as BPR exercise:

#### **Project Management**

- Project Management
- Team building

#### **Information Gathering**

- Brain storming
- Customer Surveys
- Focus groups
- Structured Analysis and Interviewing
- Facilitation

#### **Value Stream Analysis**

- Customer Value Stream Interaction Analysis
- Customer Needs Analysis
- Work-Flow Diagram
- Stake-Holder Analysis
- Information Need Analysis
- Root Cause Analysis
- Event Analysis
- Organisation Interaction Diagram
- Benchmarking
- Responsibility, Authority, Expertise, Work Analysis

#### **Social Change analysis**

- Organisation Readiness Analysis,
- Goal attainment, Adaptation, Integration and Latency Analysis

#### **Financial/Quantitative Analysis**

- Activity Based Costing
- Cost Benefit Analysis
- Cycle Time Analysis

#### **Quality**

- Pareto analysis
- Ishikawa diagram
- Quality Function Analysis
- Bias Measurement

Following are some finer points that need to be kept in mind while taking the ERP route to BPR:

1. The Company should be able to select the right ERP Project, which can be supported and managed. It should select right persons to various positions of the project team. More than anything else, the company must be able to manage the change and further that ERP must become the job of everyone involved and not just that of the top management or the project leader or the consultant.
2. The successful and skillful managing of the business process re-engineering is the distinctive competency that emerges from the integration of re-engineering and information technology. This skill has been identified as the critical requirement in the past, but has been ignored or been given more lip service. Today, its need is far greater and the company that recognizes this factor will be far more successful than those who do not. The issue is not that of technology. Technology has always been neutral. The issue is the ability to make creative use of that technology and to manage the massive change the system produces. Managing the change processes with the same degree of discipline and vigor, such technology will begin to happen more regularly when organisation see this as a core competency and start to manage it as a competitive advantage.

**The successful and the skillful managing of the business process re-engineering is the distinctive competency that emerges from the integration of re-engineering and information technology.**

3. Most of the ERP packages available in the country are foreign based. The use of the ERP package developed abroad demands even greater care and skill. To meet the challenges of globalisation, Indian organisations need to define re-engineering before implementing the ERP package. Alternatively, the best will be to decide to adopt the default business processes based on international experience as in-built ERP. This may call for and help in bringing the desired radical changes. The Business Process Re-engineering exercises and the ERP implementation begins with promises of savings

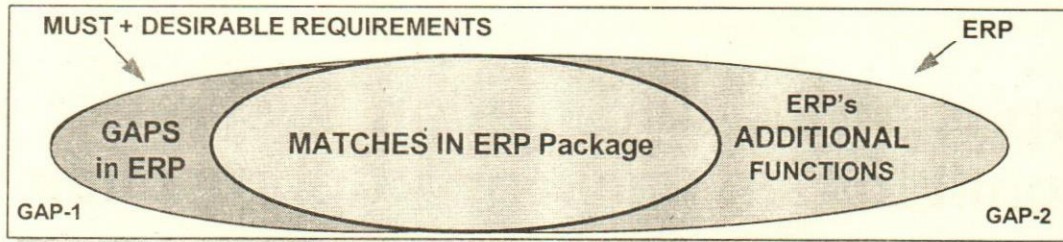


Fig. 4. 'Desirable' and 'Must' requirement of ERP package

and efficiencies. However, good number of organisations have reported frustrations—from time and cost overruns to difficulties of changing business processes to accommodate its demand. The reasons lie in the failure of the organisation to identify the critical success factors highlighted above.

4. Many organisations look for external consultants for support for Business Process Re-engineering. The practical experience has been the mix of in-house team with highly experienced consultants as facilitators. It only reduces the cost of the project but it brings about qualitative approach in the whole Business Process Re-engineering exercise. The detailed knowledge of in-house people involved in the actual usage of the system and its shortcomings and improvements required, coupled with the exposure to the new ERP based business processes will get them involved in choosing the right processes. This would significantly help in correct selection of business processes. The opening of Internet to private parties in India, is indeed heading for a major explosion in the field of communication and information technology in India. The impact could be felt in a couple of years of time. The developed countries, should we have to compete against, are already ahead in technology and are talking of using of Electronic-Commerce (E-Commerce) and Internets/Intranets and Extranets to leverage the technology advantage, over the third world. Select the ERP package which supports the modern IT and will support the future IT and communication technology.
5. No ERP package will meet the 100% requirements of the organisation as most of these ERP solutions tend to be generic or universal for application in variety of industries such as from manufacturing industry to service industry, from hotel management to aviation industry.

Therefore, there would be a between what you want and what the package offers. Analyse these gaps by classifying them into *must have*, *desirable to have* and *would like to have*. *Must is a Must*, Re-evaluate the "desirable to have" and their priorities. You may like to defer those "would like to have" features for the later stages. The conceptual and innovative abilities of the team members would play a great role in finding solutions to fill these gaps through work around solutions, etc.

These ERP packages based on proven international practices would definitely offer much more than the organisation desires to have and many features, even which the organisation is not exposed to or not even aware of. This is where the organisation can derive substantial benefit from using these available features, methods, systems, procedures etc.

### Conclusions

Business Process Re-engineering has picked up substantially in the last couple of years in the country and therefore the sharp rise in the demand of ERP solutions, if one goes by various claims by ERP providers such as SAP, BAAN, JD Edwards, MARSHAL (Ramco), MFG-Pro, Oracle—all have reported handsome growth in their business in India. SAP—India has gone on to report an 180% growth in 1997. The published figures for other vendors are not readily available. However, quick scan of the Industries going for ERP, one finds from names of large giants such as TATAS, ESSAR, RELIANCE to medium and smaller units such as Arvind Mills, Cadbury's, Hoechst, etc. Billions of rupees are and would have been spent on these implementations and therefore, it is extremely important for Indian industries to understand the complexities, dynamics, constraints of ERP implementation to ensure that every rupee spent goes to make Indian Industries highly competitive in the global arena.

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# Enterprise-wide Information Systems: Custom-built Vs Packaged Approaches

Shivraj Kanungo

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*The theme of this paper concerns managerial decision to commit to an enterprise resource planning software or to develop customized enterprise-wide information systems in-house. It is argued that since developing enterprise-wide information systems has become a sine qua non for organisational excellence, the decision to go in for "canned" solutions as opposed to customized ones has become a critical managerial decision. Intertwined with this decision problem is the process issue of the change (and the pace at which such change takes place) associated with implementing enterprise-wide information systems. An analytical framework is followed up with discussions and case studies that highlight the similarities and differences in the two approaches. It is concluded that in the Indian context, organisational preparedness becomes a key determinant of the success of enterprise computing efforts, and it includes maturity of organisational processes and coverage of existing information systems. Another finding was that both the "canned" approach and the custom-developed approach share the same essential characteristics. It is up to organisations to calibrate the rate and extent of change associated with either of the two approaches.*

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## Introduction

Enterprise-wide information systems (EWIS) are those that spans the whole organisations in terms of functional coverage (finance, marketing, production, etc.) and managerial utility (by integrating executive information systems, management decision support systems, and on-line systems). They can be custom-built or can be implemented as "canned" packages configured to an organisation's needs. Both approaches are customer-oriented and require changes to the way business is conducted. In some organisations the changes required may be drastic and in others more gradual changes may suffice. In the present paper the dynamics of implementing EWISs and how management change processes—such as BPR—are linked to such systems have been analyzed.

## Background

Organisations are fast realizing the need to become efficient and effective in a relatively short time period. They are also realizing the magnitude of the difficulties associated with such requirements. In that context, traditionally managed businesses are discovering virtues of installing or updating information technology based management systems and procedures to meet demands of customers, suppliers, associates and management.

**Organisations are fast realizing the need to become efficient and effective in a relatively short time period. They are also realizing the magnitude of the difficulties associated with such requirements.**



Cost containment repeatedly surfaces as a major business driver. As a result of increased competition in the global economy, information technology (IT) departments, along with other departments, have a major role to play in cost reduction. The fundamental idea is to do more with less. Organisations must manage with leaner IT departments while at the same time, work to increase the level of customer service (internally within the organisation and externally to the customers). To experience such improvements in a short time span, organisations are increasingly adopting the business process re-engineering (BPR) approach. In the contemporary context, BPR projects are rarely undertaken without significant IT inputs.

Strategies used to contain IT-related costs include outsourcing and the use of enterprise resource planning (ERP) packages. ERP packages integrate logistics, manufacturing, financial and human resource/payroll management functions within a company to enable enterprise-wide management of resources. The last word on the use of ERP solutions in India is not out yet. However, initial and anecdotal evidence suggests that many user organisations make premature commitments to such solutions. The company may not be technically prepared or properly staffed for such a large implementation. In addition, the ERP package will probably need to be integrated to other existing applications and the company's current infrastructure may not be able to support this integration.

**ERP packages integrate logistics, manufacturing, financial and human resource/payroll management functions within a company to enable enterprise-wide management of resources.**

Most organisations have not felt the full impact of operating globally or in relatively "free markets". However, structural changes in the economy have been significant enough to make almost all organisations in India aware of their internal inefficiencies. In turn, almost every organisation has initiated a formal or informal process of "renewing" itself. Some organisations have attempted *strategic divestments* while others have chosen to retain their *core competence*. In essence, becoming customer-centric and cost-effective by incorporating the best business processes and practices has become a common goal for nearly every organisation. Few organisations have, however, taken steps to translate that goal into practice. Since any organisation would want to improve as quickly as possible, it is in terms of "buying time" that an enterprise resource plan-

ning solution offers and supports as it streamlines and integrates information flow in the various activities of an enterprise thereby enabling the optimal use of its resources.

Consequently, it is not surprising then that leading vendors of ERP solutions are increasing their presence in India. Global ERP vendors have upgraded their presence from liaison offices to wholly owned subsidiaries in India in the recent past. Attempting to join ranks of these companies, local ERP vendors are also entering the market. In 1995-96, 80 organisations had implemented ERP solutions across the country. One reason for this is that multinational corporations (MNCs) in India need to mirror their global information systems (many of which are ERP-based).

The ERP market in India has been growing continuously. It grew from Rs.518 million in 1995-96 to Rs.753 million in 1996-97, an increase of 45.4 per cent. In the next financial year, the increase was even steeper, of the order of 52.1 per cent (Gupta and Sharma, 1998). With this background it is important to understand what is the attraction of ERP for managers and whether organisations should opt for the ERP option in lieu of the custom-developed information system.

#### **The Input Process Output & Outcome Model**

The fundamental difference between any other technology, say automotive technology, and information technology lies not necessarily in terms of the technological framework but in the nature of input and output. Unlike other traditional definitions of simple I/O systems (with or without feed back), another dimension is added. This additional dimension called "outcome" is managerially most useful. This is shown in Fig. 1. The organisational implication can be understood in that neither the amount of input (e.g. hours worked, money poured in, etc.), nor the amount of output (how thick the reports are, how excited employees or customers can get about a product etc.) matters if the outcome (bottom-line profits) is not achieved.

An information system in an organisation, regardless of how well it has been conceived, designed, and implemented, will not result in organisational effectiveness if it is not used "properly" or appropriately by the users. Organisational intent is critical. Therefore, when using or managing information technology, a manager needs to understand and convey to those around him/her that information technology is necessary but not sufficient to result in organisational effectiveness as shown in Fig. 2. Organisational effectiveness is the eventual goal for IT use in organisations. Increases in

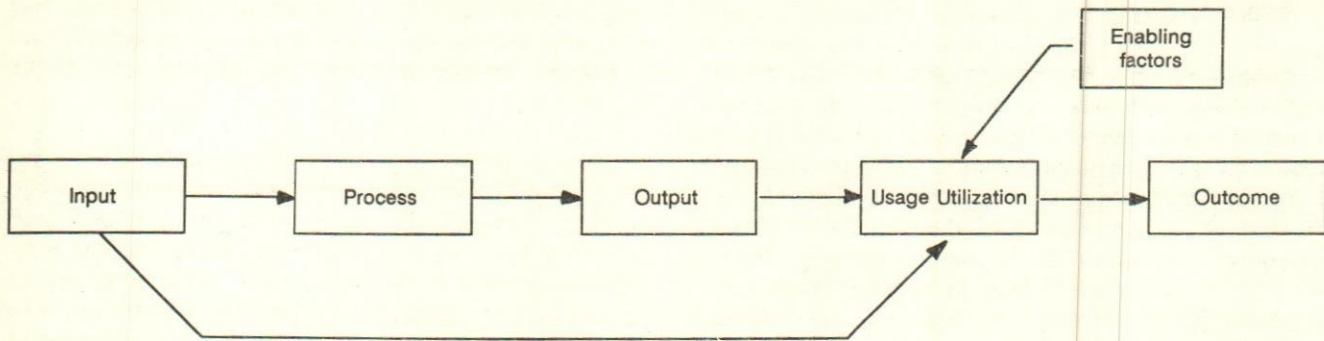


Fig. 1. Input-process-output-outcome framework

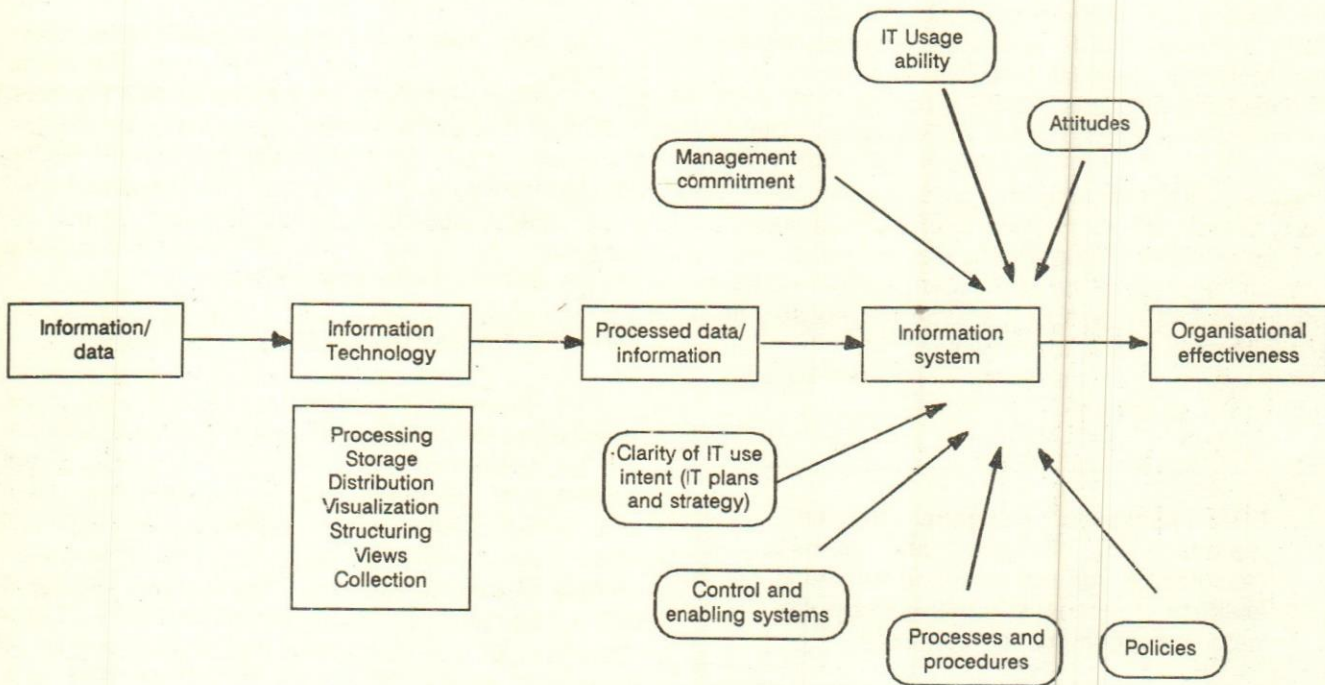


Fig. 2. Organisation IT use framework

personal efficiency, group productivity, and system throughput – all add up to increase organisational effectiveness. The managerial implication of this analytical framework is that IT is necessary but not sufficient for organisational excellence. There are numerous alternative strategies that can be adopted to conceptualize about, and implement, IT in organisations. In doing so it is important to avoid becoming IT-centric. Managers, including IT managers, should always remain focussed on the organisation implications of IT use.

Enterprise information systems are required to make a significant impact on organisational effectiveness. The most non-controversial measure of or-

**An information system in an organisation, regardless of how well it has been conceived, designed, and implemented, will not result in organisational effectiveness if it is not used “properly” or appropriately by the users.**

organisational effectiveness is return on investment (ROI) for which there are many measures. EWISs are attractive because they make an impact on organisational outcomes.

## The Paradox

Firstly, IT is accessible and relevant to almost everyone in the organisation. Secondly, there are extremely visible exemplars of organisations that have realized phenomenal success based on their investments in IT. In addition, there are very few barriers to entry for IT into organisations. Consequently, organisations find IT as an attractive tool to improve organisational effectiveness. It is obvious that this logic is simplistic. Today's IT decisions are far more complicated.

Most organisations are starting to have well established IT setups. Many of these IT setups house systems that are fast becoming legacy systems. Legacy applications and data are those that have been inherited from languages, platforms, and techniques earlier than current technology. Most enterprises that use computers have legacy applications and databases that serve critical business needs. Typically, the challenge is to keep the legacy application running while converting it to newer, more efficient code that makes use of new technology and programmer skills. In the past, much programming has been written for specific manufacturers' operating systems. Currently, many companies are attempting to migrate their legacy applications to new programming languages and operating systems that follow open or standard programming interfaces. Theoretically, this will make it easier in the future to update applications without having to rewrite them entirely and will allow a company to use its applications on any manufacturer's operating system.

**Legacy applications and data are those that have been inherited from languages, platforms, and techniques earlier than current technology.**

IT provides efficiencies while well-designed and well-established management systems provide effectiveness. It is in this context that organisations must realize that changing or improving IT will have negligible results on organisational effectiveness if the associated systems (like the steps involved in procurement or customer query response) are not concurrently streamlined. Organisations face the following decision scenario: either upgrade the technology first and make organisational improvements later or start with organisational improvements and then upgrade the technology. A parallel decision that organisations need to take is to manage its IT development in-house or to outsource a major portion of its IT development and management activities.

**Changing or improving IT will have negligible results on organisational effectiveness if the associated systems are not concurrently streamlined.**

It is obvious that the nature of organisational improvements in terms of increased competitiveness and customer focus required by contemporary organisations can not be achieved without enterprise-wide information systems. As already mentioned, an enterprise-wide information system (EWIS) is one that spans the whole organisation in terms of functional coverage (finance, marketing, production, etc.) and managerial utility (by integrating executive information systems, management decision support systems, and on-line systems). This decision is difficult of organisations that have made significant investments in IT. If an organisation already has a large information system, the decision problem changes into whether to develop the existing system into an EWIS or go for ERP at that stage.

## Investment

IT investment can be measured in terms of financial resources, technology dependence, and manpower profiles. Large multi-location organisations may have invested significantly in terms of money and time in developing an organisation-wide sales tracking system. Unless the technology used is completely obsolete, it is not advisable to replace that system by an ERP system that covers other areas as well. A possibility is to let the existing system remain and implement an ERP solution to complement this functionality. This approach creates additional complexities for implementers as well as managers.

## IT Competency

Many executives feel that the in-house IT setup is not capable of developing and managing EWISs. They believe that an outsourced ERP solution would not only buy the organisation time, but would also simplify the process of IT implementation and management. Implementing an ERP in this framework is flawed. Technical and managerial competencies internal to an organisation are crucial for any large-scale IT effort in organisations. Therefore, organisations should not choose to go the ERP route to bypass internal IT management problems.

There are many organisations where the ERP concept may not be applicable. The essence of the ERP approach is that most organisations broadly share certain process

characteristics. Some of these processes are inbound logistics, outbound logistics, production/manufacturing, management etc. Organisations within an industry share process characteristics even further. What differentiates organisations from one another is the way these processes are operationalized. If we take Indian Railways as an organisation, we will find that its operations are unique. The protocols that are used to run trains in India, their traffic intensity, their fare structure, their scheduling and other characteristics are so unique that no other railway could resemble it, except from a very abstract level. In such cases an ERP solution is ruled out.

Quite often, IT development and management activities are stymied by top management perceptions and overall organisational inefficiencies. Internal IT solutions are necessarily custom-built. Therefore, they tend to mirror and, at times, amplify the existing organisational inefficiencies. Had the IT group been given the freedom to operate at a level where they could have suggested operational and process-related changes, they could have implemented information systems for such improved organisational processes. Therefore, in organisations where well developed information systems exist, introduction of an ERP to replace existing information system is often done as an excuse for justifying organisational changes. But since such an approach represents managerial opportunism more than a well thought out managerial strategy, it is more likely to fail.

**In organisations where well developed information systems exist, introduction of an ERP to replace existing information system is often done as an excuse for justifying organisational changes.**

### **Lack of Organisational Preparedness**

Many organisations in India have in place, processes and procedures that were designed, developed, and implemented in an era where the "seller" was the king. Monopolies, licences, and permits implied secrecy and a lack of organisational transparency. Most organisations have not changed their practices since then. Superficial or incremental changes may have crept into such systems. But even today, most organisations can not claim to be ready for drastic improvements using IT. Many organisations do not have well documented organisational processes. For those organisations that do have documented organisational processes, they do not match those in practice. Hence, the organisational and managerial discipline that is required for meaningful IT

usage is lacking. For such organisations, it is not advisable to go in for ERP solutions.

The main arguments for going in for an ERP approach include saving time, leveraging existing IT competencies, meeting global requirements, and ROI criteria. Many organisations believe that an off-the-shelf solution to their IT needs will be more responsive to them. In such scenarios time is of essence, and the management is convinced that writing code for organisational specific applications is going to take longer than implementing an ERP solution. Typical examples include the merger of two banks to form one entity. Instead of re-engineering the two information systems to look more like each other, the merged entity may find it useful to implement an ERP system. Additional advantages include the fact that hard-to-implement and useful features come encapsulated with such systems. Such features include "industry best practices", built-in flexible architectures, seamless integration across heterogeneous hardware platforms, etc.

Many organisations that have well established IT systems that have proved to be very useful for the organisation face the prospect of seeing such systems becoming legacy systems. This also creates additional problems for the organisation in terms of being unable to retain bright technical IT professionals who prefer to work with leading edge technologies. Since legacy applications are expensive and cumbersome to maintain (since applications could reside on totally different and incompatible platforms) and since existing management processes are well-documented and adequately mapped, ERP solutions offer a logical climb into the technology ladder. It is important to realize that this is possible because of the existing IT competencies and well established processes in place.

### **Meeting global requirements**

Multinational and transnational organisations that have operations and offices in India often develop their IT infrastructure to be compatible to the global systems in place. IT-related policies and directions emanate from the global headquarters. In such scenarios, if corporate policy warrants a specific ERP solution, that will be implemented worldwide. It is important to note that organisations operating globally have strong documentation systems for their organisational processes in addition to equally good management control and audit systems. These management systems are processes are uniformly followed worldwide. The existence of such strong processes eases ERP implementation significantly.

## ROI criteria

The return on investment (ROI) framework for managerial decisions is, by far, the strongest to decide in favour of going in for ERP solutions. There are three major components to the cost of ERP projects: people, data and technology. The benefits come mostly in terms of costs saved.

The strongest reasons for going in for ERP solutions tend to be ROI-based. The major pitfall in terms of ERP solutions has to do with lack of organisational readiness. This is because ERP superimposed on weak organisational processes, inaccurate databases and ineffective change management can result in significant organisational embarrassment and trauma.

## Case Studies

Of the two cases presented here, the first one describes ERP implementation and associated issues in Apollo Tyres Ltd. The second provides insights into the organisational dynamics and results associated with an EWIS in Timex Watches Ltd.

### Apollo Tyres Limited

In 1994, Apollo Tyres Ltd (ATL) saw itself going through a radical metamorphosis in the IT front. It decided to employ IT as an effective tool to deal with the growing business requirements related to increasing competition, rising customer expectations, reduction of scrap and rework, economizing the production cost and improving the process capability and yield. But with the rapid growth of company, it became imperative to integrate the information from hitherto independent or isolated departments into a synergistic whole. For example the data from the Marketing Support System and the Production System need to be always meshed for effective decision making at top levels. Therefore the idea emerged to create an enterprise-wide network of hardware and software on a common platform (Verghese, 1998).

Custom software development is a time consuming and risky endeavour. The specifications are normally derived after understanding the business processes, identifying their shortcomings and then developing the requirements of the proposed system, design, development, testing and implementation. The weakest link is to define the system requirements while keeping the software flexible enough to respond to business changes. Rarely are the users able to explicitly define their requirements in one go and often

these requirements evolve in a spiral and undergo a major change after the system is developed. Even without this change problem, the system will take at least 2-3 years and would involve 400-600 person-months for this activity.

**Rarely are the users able to explicitly define their requirements in one go and often these requirements evolve in a spiral and undergo a major change after the system is developed.**

Therefore the alternative was to go in for an ERP package like BAAN, Oracle Applications, SAP, JD Edwards, MARSHAL etc. The packages were evaluated on basis of their functionality, costs vendor support, ease of customization and adaptation. For the evaluation of various ERP vendors and their packages, the company collected information from the respective vendors in a structured manner.

By the end of 1996 the company acquired MARSHAL from Madras based Ramco Systems Ltd. with SQL Server on Windows NT platform which offered rich features and was cost effective as well.

### Business Objectives

A SWOT analysis was used to identify the internal and external forces that drive an organisation's competitive position in the market. The results from the SWOT analysis were used for implementing the BPR activities and the subsequent ERP implementation. This converted to focussed business objectives of:

- Improving the share holder value
- Cost reduction
- Cycle time reduction
- Effective management of logistics and realization control.
- Minimize redundancy of information across organisation.
- Access to information from any place at any given point of time for effective decision making.

In terms of organisational priorities, the prime business objectives have been customer satisfaction, employee motivation, market share and return on assets as drivers of shareholder value.

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## Implementation

ERP package is much more than an IT project. The earlier approach of developing systems has to be changed. ERP demands a new implementation development process, which takes far more resources from the user community than ever before. It is typically user-driven, based on re-engineering approaches and will usually derive greater change than any system developed regular way. More than ever, the ability to manage change must become the job of everyone involved, not just that of a consultant or the project leader.

For ATL changing from a manual system, with islands of computerization to an integrated on-line system like MARSHAL would be a major change. As the core business remain unchanged, they were not prepared to reinvest the business and business processes from the scratch. So it was decided to streamline and integrate the processes to bring adequate benefits with a level of change that the organisation could handle. It was decided to re-engineer process again and again thus implementing "continuous business re-engineering" without major disruptive side effects of a radical BPR. The need for communicating and exposing the organisation to ERP system and BPR was necessary. Thus ATL has decided to go through the phased or channelled Approach for ERP implementation.

A three phased approach for engineering the BPR was implemented through:

- Understanding the Current Value Stream
- Making the organisation ready for the change.
- Assess the current value stream and re-engineer.

## Dividends from ERP

The massive restructuring has cost the company nearly Rs. 6 crores inclusive of hardware, software and networking costs. As far as the returns on investment are concerned, the qualitative returns have been appreciated much more than the traditional concept of a return on investment. The implementation of MARSHAL has resulted in better co-ordination and streamlining of the activities between far flung plants and the head office. With the communication system in place, the HO is well informed of the entire operations in the plants.

Another benefit to ATL has been flexibility, adaptability and quickness of operations, as access to all relevant information has made quick decision-making possible. Besides simultaneous updating of information

has helped ATL employees to take decisions based on present events and not past records.

Apart from these qualitative benefits, the most significant and visible quantitative benefit has been in terms of reduced claims. The company has managed to reduce the claims to less than half a percentage. Claims are vital to the tyre manufacturing company as high claims can at times wipe out the entire profit.

## Pitfalls/Failures

The system though designed and intended to be an effective ERP system in all areas, didn't bring the desired results in some areas. The materials management module was not implemented and used by the users in the right spirit. The primary drawback it was that it didn't produce the correct on-line inventory status. The company tried to do further enhancements and customizations of the module, but still it didn't produce any overall positive change. The material management system was for sometime put on hold in other locations for further analysis.

Sales management module, when implemented, eliminated a lot of non-productive processes and activities thus resulting in significant cost savings. This necessitated doing away with many of the commercial activities of each branch office and some employees in that category had to be relocated or retrenched. This distressed many employees through out the organisation who resorted to protests and strikes. This created a negative perception for the ERP system throughout the sales offices.

Though consultants have provided requisite training for the key users of the system, the process of learning and training has not yet percolated down the hierarchy. Many lower level users are still unaware of the integration of various processes and the exact benefits of the ERP system.

Though some modules have been very effective and widely accepted, management still feels that the ERP implementation at ATL has not reached the stability and maturity to deliver business benefits in a significant measure. One of the major reasons is the inefficiency of the materials management module at plant level. This has stalled the integrated flow of process and information across various modules. This has resulted in reverting back to the previous system of updating the information manually at the corporate office. Management has not been able to tackle, in its entirety, issues of fear and anxiety of a section of employees regarding downsizing. In addition, there were cost overruns in this project that forced management to undertake a thorough review

before allowing further investments or enhancements on the existing system. The departure of some of the key personnel from the IT department also resulted in many impediments in the dealings with the system consultants.

**Inefficiency of the materials management module at plant level has stalled the integrated flow of process and information across various modules.**

### *Timex Watches Limited (TWL)*

The single factor which ensured a superior Information Systems (IS) experience for TWL (Masilamani & Khare, 1996) more than any other has been the company's unwillingness to be pushed too early and unwisely into acquisition of hardware and software facilities. This was a difficult task in view of both promoters having their own preferences based on the experiences in their respective companies. The American partner had pursued IS development with IBM mainframes and developed them to the point where they themselves had admitted the organisation was suffering from information overload and over kill (too much detail and computational accuracy unnecessary for sound decision making). The Indian partner had experimented with various hardware and software configurations and employed a mix of in-house systems development as well as packaged software and even relied on outside consultants to develop and implement systems on a turn-key basis. We suspect a dissonance may have developed between the real world organisation and its information needs and admittedly the expensive hardware and software resources were unable to deliver adequately on the organisation's information needs. TWL while having access to the facilities and systems building capability of its promoter organisations', decided to first assess its needs carefully and decide on its implementation priority for IS within its fledgling organisation. This has paid off handsomely with the company being able to develop a sound base for information systems and to progressively leverage growing systems capability within the organisation and fully utilize the power of the hardware and software configurations that it has decided on from time to time.

### *Applications portfolio*

Our applications portfolio spans the entire gamut of organisational functions from HR through Manufacturing and Logistics to Financial Accounting and Share Processing. Table 1 lists the major application areas with their primary users and a brief description of their coverage.

**Table 1:** Details of ERP Applications in Timex Watches Ltd.

Application	Primary User Dept	Coverage
Personnel Information System	Human Resources	<ul style="list-style-type: none"> <li>• Employee attendance</li> <li>• Employee performance appraisal</li> <li>• Employee health status</li> <li>• Employee qualification/training details</li> </ul>
Material Planning and Procurement System	Materials	<ul style="list-style-type: none"> <li>• Production planning</li> <li>• Material planning</li> <li>• Ordering</li> <li>• Bill of materials</li> <li>• Custom clearance</li> <li>• Material receipts</li> </ul>
Inventory Control System	Finance & Materials	<ul style="list-style-type: none"> <li>• Standard vs actual usual of material</li> <li>• Inventory status</li> </ul>
On-line Work-in-progress monitoring system	Production	<ul style="list-style-type: none"> <li>• Monitoring of production at various stage of production</li> <li>• Shop floor inventory</li> </ul>
Shipping system	Despatch	<ul style="list-style-type: none"> <li>• Despatch of finished goods</li> <li>• Tracking of goods prior to point of destination</li> </ul>
Share Accounting System	Shares	<ul style="list-style-type: none"> <li>• Investor queries</li> <li>• Share transfers dividend payment</li> </ul>
Financial Accounting	Finance & Accounts	<ul style="list-style-type: none"> <li>• Accounting Ledgers</li> <li>• Vendor payments</li> <li>• Profit &amp; Loss account</li> <li>• Trial balance &amp; balance sheet</li> </ul>

**Table 2:** Comparison between TWL and Another Leading Watch Company

Comparison with leading watch company	Leading Watch company	Timex
Total Manpower	1750	630
Watch production (nos. per employee)	1570	3210
Investment in I.T. (Rs. crores)	7.50	2.00
Inventory turnover ratio (1995-96)	2.29	3.05
Manpower Reduction (over 3 year period)*	NA	100

**Note:** \* Reduced manpower re-deployed, vacant positions not filled

Information from the sales and marketing areas are linked to the organisation through the corporate finance function. The positive results of TWL System approach and improvements in speed/productivity, are given in two tables 2 and 3.

**Table 3:** Cycle Time Reduction at TWL

Reduction in Cycle Times	Year 1	Year 3
Watch Production	15 days	7 days
Annual Accounts Closing	90 days	45 days

### Action Frameworks

A framework for managerial action to build EWIS using the in-house approach or the ERP approach is detailed as follows. The in-house approach has been documented from the interactions with TWL and the ERP approach presented here is derived from ongoing research at the Baan Unit for Excellence in Enterprise Applications in the Department of Management at Indian Institute of Technology, Delhi.

#### *In-house approach*

As shown in Fig. 3, the essence of the whole process of in-house development of information systems at TWL is aimed at clarifying and formalizing the processes at TWL. An incremental approach is followed at TWL. The idea is to avoid rushing in for IT based systems. The steps are very clearly delineated.

When a request is made to the IS group for an information system the first step is to identify whether a manual system exists for the process to be automated. If a manual system does not exist, a manual system has to be developed. This system has to be documented and analyzed for existing inefficiencies. This is called process mapping in the BPR context. Since every system is user driven and the user is responsible for stating requirements and eventually accepting the system, users must have a palpable basis for conducting negotiations with the IS department staff.

The next phase of analysis has to do with the level of technology required to resolve the information system requirements. The level of information technology is a function of the scope of the system, amount of data, nature of data and the level of end-user IT skills. If the scope of the system is limited to one or two users and the data requirements are moderate (as in having departmental scope) a spreadsheet solution is recommended. When the users agree, they are provided training on the spreadsheet and the system is developed for (or with) the user. Database solutions are opted when systems have cross-departmental implications and data volumes are large (thousands of records or transactions) and there are multiple users of these systems. After system requirements and specifications are developed with the users/promoters of the systems, the final sign-off from the departmental heads is taken. This

is done to avoid a conflict in how a system is operationalized by users and how that same system is understood by the heads of departments. After the system is developed and tested, any remaining changes are completed. At that stage the system is formalized and documented. Documentation is important for management control and audit. It is to be noticed that this approach has built into itself aspects of re-engineering and process mapping. The difference from traditional BPR approaches is that no requirements exist for radical and quick improvements. Organisational change takes place at a pace, that the organisation can sustain. The scope of this approach is organisation-wide but the approach is piece-meal.

The advantage of this approach is that organisations allow themselves to experience collective learning and develop managerial and technical competencies. This approach takes a longer time to evolve and embed itself in an organisation. But once it is established, this managerial framework will be able to respond to in-house as well as ERP solutions also.

#### *ERP approach*

This is a software image of the major business processes and value streams of an organisation, such as customer order fulfillment and manufacturing. Its effectiveness depends upon coverage of organisational functions. Consequently a partial implementation of any ERP system is not much better than the legacy system it replaces. In many instances, it is worse because the older system was written to specifications for the organisation and the task. ERP's set of generic processes makes sense only when used to connect the different parts of an organisation. The attraction of information integration for CEOs and managers is an important indicator of contemporary managerial requirements.

Almost all ERP solutions are software-centered. ERP is a software, which if implemented well, will result in significant organisational effectiveness. The normal sequence of activities starts with mapping organisational processes, re-engineering them (if required), identifying important value streams that make up those processes, prioritizing processes/value streams as to which ones to automate in which sequence, implementing the system and performance evaluation. Activities like training and software development for parts of the system that the ERP will not cover are interspersed.

The ERP approach requires organisations to develop and exhibit very high levels of managerial coordination and discipline. Three major players in an ERP project include the ERP vendor, the ERP implementation



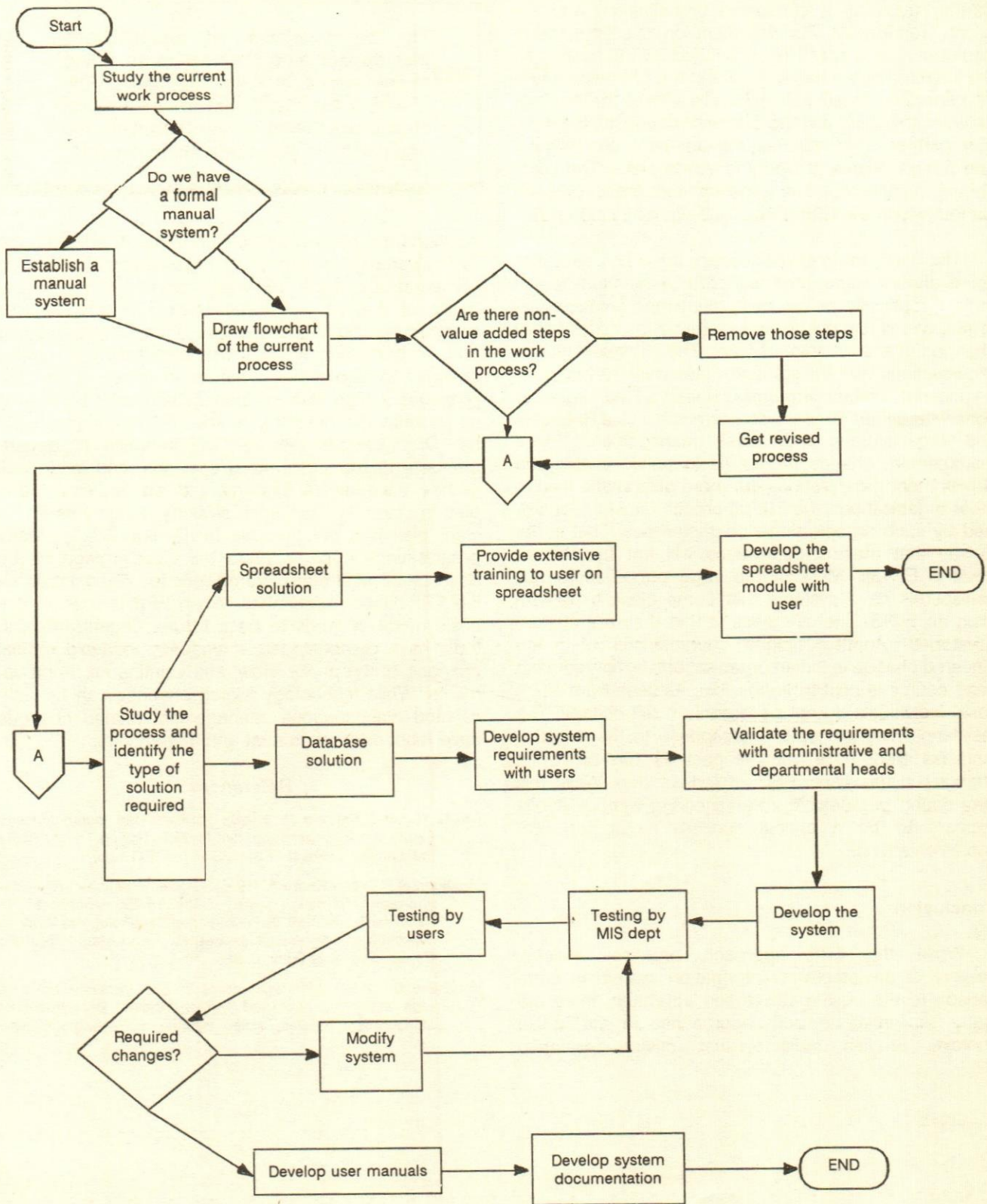


Fig. 3. In-house development of Information System (IS) – Block Diagram

partner (typically a consulting organisation) and the client organisation. For the client organisation, the IT department or a specially constituted task force acts as the interface between the client and the ERP vendor and or a specially constituted task force acts as the interface between the client and the ERP vendor and implementation partner. This requires management commitment and a high degree of clarity in action plans. The client should demonstrate the urgency and proactive spirit without which the ERP project will slip on its schedule.

There are some specific issues regarding organisational change associated with ERP implementation in India. Specifically, as has been mentioned before, some organisations can not be re-engineered (as in drastically changed in a short span of time). The characteristics of organisations that do not lend themselves to being re-engineered include largeness, one-of-a-kind organisations with unique process characteristics (like Railways) and organisations with weak management. Since management change processes in public sector and Government organisations are more phlegmatic than in other organisations, the ERP approach may be jeopardized by such organisational characteristics. That is not to say that these organisations will not be able to develop EWISs. Most of the large public sector organisations have systems that come close to resembling an EWIS. The difference is that they are custom developed. Another unique characteristic of re-engineered change in Indian organisations is that reducing head counts is next to impossible. As seen from ATL's case, individuals do not necessarily resist change. The resistance they put up is in response to the negative fantasies they have with respect to the proposed change—in this case, ERP implementation. While this may sound paradoxical, re-engineering without layoffs appears to be a critical success factor for ERP implementations.

## Conclusion

While the ERP approach promises quicker delivery of an integrated information system in comparison to the custom-developed approach, there are many similarities to both approaches in the Indian context. Studies indicate that custom-developed

**The characteristics of organisations that do not lend themselves to being re-engineered include largeness, one-of-a-kind organisations with unique process characteristics (like Railways) and organisations with weak management.**

solutions are relative cheaper in India. In addition, the ERP approach may buy an organisation time but is comparatively more expensive and risk prone because of the ambient organisational factors. Factors common to both approaches include benchmarking and a combination of incrementalism and radical change. To experience success in either of the approaches a high level of managerial clarity must exist as to what the outcome of the IT investment should be. Organisations that rely on in-house IT departments to deliver customized solutions tend to do well if they have an IT strategy and an implementation plan in place. Without such strategy documents and a clear plan it is not possible to develop EWISs. Many organisations hope to undo the disadvantage of the absence of a strategic framework for IT by introducing ERP-based approaches. When ERP is used in this crisis mode, it tends to be a failure. Organisations in India have demonstrated a tendency to avoid radical changes and opt for slow and continuous improvements. While technology-related changes can be radical and discontinuous, management related changes have tended to be gradual and incremental.

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# Integrating BPR with Productivity

G.D. Sardana

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*Globalization of Indian economy in the era of liberalization and competition has forced several paradigms for transformation in a business organisation. In particular, BPR has been recognized as a vital tool to ensure better productivity management. The present paper envisages to explain and establish the inter-relationship of BPR with productivity. Thus BPR and productivity have direct linkages. The role of information technology (IT) is stressed as BPR is essentially customer/market oriented with focus on industrial performance measures like cost, service and speed.*

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Globalization, the WTO agenda and new economic order has brought sweeping changes on the industrial front. It has ushered in an era of liberalisation, economic reforms and increased competition. Industry can no longer look forward to government support it once received in the form of regulated and controlled imports, preferences, restrictions on new units etc. These are possible to be achieved through restructuring of the organisation and building up an overall culture of productivity in the enterprise. Perhaps, at no other time productivity orientation was an imperative need for success as it has become now. Indeed, the challenge of globalisation can be summarised as 'Increase productivity or perish.'

In this context, Business Process Re-engineering (BPR) is an important and proven technique to bring about transformation in an organisation. BPR and productivity management are interrelated. The paper sets to explain and establish the interrelationship.

## Business Process Re-engineering

Ever since the term BPR was coined by Michael Hammer, it has come to be recognised as a remedy for corporate survival. Many consider it as a solution for the increased competition that is gripping the business enterprises. It is thought to be an answer to the onslaught of TQM and JIT. For developing economies faced with the irreversible option of liberalisation of economy and trade, BPR is being increasingly recommended as the only alternative.

According to Michael Hammer, BPR comprises fundamental rethinking and radical redesign of business processes to achieve dramatic improvement in critical, contemporary measures of performance, such as cost, quality, service and speed (Jayaraman *et al*, 1994). This concept has been enlarged by adding the suffix, "with or without breakpoint" to the term BPR (Johansson *et al*, 1993). They define BPR as, 'the means by which an organisation can achieve radical change in performance as measured by cost, cycle time, service, and quality, by

the application of a variety of tools and techniques that focus on the business as a set of related customer-oriented core business processes rather than a set of organisational functions. They further explain "break-point" as "the achievement of excellence in one or more, of the values the market puts on products and services. Obolensky (1994) views BPR as, 'what an organisation undertakes to change its internal processes and controls from a traditional vertical, functional hierarchy to a horizontal cross functional team.

However, amongst these authoritative interpretations there are similarities. The most commonly accepted attributes and salient characteristics of BPR can be summarised as under:

#### **Focus on organisation**

Traditionally, all improvement action plans and management concepts have focused on discrete tasks such as sales, marketing, finance, quality etc. The efforts have been directed to improve the performance of functional areas of production management, finance and accounts, planning etc. BPR lays focus and deals with operational problems. The processes are examined at task level and changes made involve task-rearrangements (Balle, 1995). BPR covers a wider span of change programmes covering the entire organisation. Its impact across an organisation and the extent of strategic change is high as compared to other improvement techniques such as quality circles, process re-design, TQM, JIT, time-based competition etc. The organisation is perceived as an integrated whole.

**BPR lays focus and deals with operational problems. The processes are examined at task level and changes made involve task-rearrangements.**

#### **Focus on business goals**

BPR places a high degree of stress on seeking clarity of business objectives. It emphasizes that one must clearly understand as to what is required to be changed and why the change is needed. It requires that the business process selected for change should be critical and contemporary. As an organisation caters to the needs of four categories of key stakeholders viz., customers, employees, suppliers and shareholders, their needs must be fully understood and analysed to draw up an agenda for re-engineering. It is however, the customer which occupies a place of predominance, because it is he who eventually pays for the product and

services and the expenses incurred by the organisation. Business goals are necessarily market/customer driven. The real significant need for re-engineering requires to be customer focused. BPR should help increase value addition to the customer. Any step or activity undertaken under BPR should essentially and foremost be first directed towards market or customers.

**BPR places a high degree of stress on seeking clarity of business objectives. It emphasizes that one must clearly understand as to what is required to be changed and why the change is needed.**

#### **Identification of key processes for re-engineering**

An analysis of the needs of the key stakeholders leads to a host of change opportunities which require process re-engineering. Obviously, all of the change opportunities which emerge will not have equal impact on implementation. Besides, it may not be possible to take up re-engineering for all the change opportunities simultaneously. There are always constraints of resources. It is therefore, necessary to first draw up a list of such opportunities which are important from the point of view of their contribution. These are the key processes. Identification of key areas establishes priorities and provides a broad idea of the cost-benefit analysis of the proposed change.

#### **Process attributes and measures of performance**

Right selection of process attributes is the key to the success of BPR. Many authors have emphasized this aspect. Obolensky (1994) has desired that the exercise should be pursued to generate detailed objectives which should possess attributes of being specific (not a broad spectrum), measurable, achievable, result oriented and time specific. Unachievable objectives can only result in demotivation of employees entrusted with implementation. Measures of performance which are generally based on financial performance evaluation or productivity ratios related to factors of inputs (labour, capital etc.) do not help to achieve these objectives.

Jayaraman *et al*, (1994) very rightly recommend that the process attributes and the objectives derived should be first measured in the existing state before the process re-engineering. This will provide a proper comprehension of the state of process to be re-engineered and the available gap or the attainable

potential. A comparison is then possible with the achievement once the process of re-engineering is over. The exercise has an additional advantage of understanding the measurement problems.

### **Focus on dramatic improvement**

This is the cornerstone of BPR initiative. Management tools such as TQM, JIT, Kaizen, Quality Circles have laid importance on strategies of continuous improvement. This is quite understandable because all the improvement strategies have been confined so far to functional departments or have been task oriented. The improvement action plans based on these strategies have emphasized the role of these approaches as departmental activities. Quality Circles or even TQM operate at shop floor levels as tools bound by procedures, rules and regulations. As a result, the performance achievement is on continual basis but in comparatively small measures. Besides, the efforts are divergently applied in all directions and activities even where the attainable potential is low. This frittering away of energies takes place because there is no provision to assess beforehand the potential of improvement under these approaches.

BPR on the other hand differentiates itself from other processes as it is directed to achieve dramatic improvements. As a sequential methodology it first requires identification and measurement of existing process attributes and performance levels, followed by setting up of targets for the same which are achievable. This establishes the gap which can be termed as the potential for achievement. Under BPR, such measures are to be selected first, which provide a scope for a dramatic improvement.

**BPR differentiates itself from other processes as it is directed to achieve dramatic improvements.**

### **Role of Information Technology**

Role of IT hitherto has been largely limited as a 'tool to speed up or support the existing process'. However, in the context of BPR, the role of IT has a high significance. IT acts as a tool to 'simplify the process through obliteration wherever possible' (Jayaraman *et al*, 1994). BPR is essentially customer/market oriented with particular focus on performance measures as cost, service and speed. In a large number of cases customers or market segments do not get the right model of the product desired or services in the form of main-

tenance spares or despatches on time because of lack of information or communications getting delayed. With increased competition this results in loss of business. However, with IT having reached a stage of development as it is now, it should be logical to assume that many departments which purely acted as 'information storage centres' or 'courier office' etc., can be entirely eliminated. Dealers can be linked directly to the network to get the information or services eliminating the need of many intermediates.

**In a large number of cases customers or market segments do not get the right model of the product or services because of lack of information or communications getting delayed.**

BPR and productivity have direct linkages. This can be examined by first understanding the concept of productivity.

### **Productivity**

Conventionally it is the ratio of output to inputs. The outputs have generally been accounted for as the goods produced or goods sold or the value of services rendered and very often as turnover achieved or the profits realised. Variations in advanced models have viewed output as 'value addition', aggregated economic benefits etc. Inputs on the other hand have been traditionally confined to labour, materials and capital. Use of only one input factor has provided the nomenclature of factorial productivity such as labour productivity, capital productivity etc. Elaborate methodologies have been suggested by several authors as to how to aggregate the different inputs or how to convert the same to a common base and reference period.

The conventional output-input models suffer from many flaws, deficiencies, conceptual inadequacies and measurement problems. These approaches imply reliance on a stimulus-response model of causality that an input causes an output. It presumes that an organisation is a simple static system and its performance is regulated by an input. This situation is possible where the variables and their relationships are fully defined in a precise manner through automatic controls and engineering specifications. Organisations on the other hand are creative dynamic systems. They are characterised by complexities of inter-relationships between the outputs and the inputs. The ratio and the mix of various inputs undergo change on a continuous basis and it is not rational to

presume that a change in input will bring a proportional change in the level of output.

It is also further assumed that the aggregation of several differing inputs follows the law of addition. In practice, this is not the case. Sometimes an incremental increase in one input can result in higher growth. The additive property of inputs has never been proved. Conversion of all outputs and specifically the inputs into monetary units is again a questionable proposal because it is possible to evaluate only economic parameters in monetary units. Besides, performance also consists of several other usually unquantifiable and qualitative outputs as services rendered, customer satisfaction, quality of products/services, schedules or tasks completed, checks/audits carried out, responsibilities met, standards reached, social benefits/service provided to society, negative value outputs (pollutants) etc. Similarly the inputs also comprise of factors as skills, budgets, technology, attitudes, infrastructure, external environment etc. These are not represented in conventional models. Concept of factorial productivity has another serious limitation. Labour of material or capital cannot be viewed in total isolation from each other. These factors are interdependent and influence each other. Increase in productivity on account of one factor is very often at the sacrifice of productivity of another factor. For example, labour productivity can be increased by using costlier materials with advanced degree of fabrication which in turn will provide decreased productivity of materials.

**Conversion of all outputs and specifically the inputs into monetary units is again a questionable proposal because it is possible to evaluate only economic parameters in monetary units.**

**System Productivity**

This concept is rational and logical in approach and provides a framework whereon to build a model to measure productivity in all applications. Johnson *et al.*, (1963) define a system as an organised or complex whole, an assemblage or combination of things or parts forming a complex or unitary whole. System approach emphasizes that an organisation be considered as a unitary whole.

The components of a system interact and influence each other to produce a total performance. A system's performance cannot be seen in isolation to

the impact of the other systems except in a limited way. In the latter case sub-systems can be created with boundaries so as to form one congruent organic organisation, within the system, with a major group of activities having a commonality of objectives. Systems approach, therefore recognises a system to be more than the sum of its parts and emphasises the need to understand the organisation and interactions among its constituent components. Systems approach signifies a radical departure from the functional approach to management. Inputs are not perceived as the conventional inputs of labour, capital or materials as these do not in themselves form sub-systems. Similarly, a system's performance is total achievement of both tangible and intangible outputs. Productivity of a system signifies as to how well a system is performing towards the attainment of its goals.

**A system's performance is total achievement of both tangible and intangible outputs. Productivity of a system signifies as to how well a system is performing towards the attainment of its goals.**

Sardana and Prem Vrat (1987) have defined productivity under this concept as "Productivity as an index of a systems' (or sub-systems'), performance indicates the extent of actual accomplishment of performance objectives in relation to the attainable level in a given external environment".

Smith's Omni Factor model, Mason's approach to measure 'bounded output productivity' and 'systemic productivity' are recent attempts to evaluate systems productivity (Prem Vrat *et al*, 1998). Multicriterial Performance and Productivity Measurement Technique (MCP, PMT) are valuable methodologies as developed at Ohio State University (Prem Vrat *et al*, 1998). Sardana and Prem Vrat (1987) have presented a model termed as PO-P (Performance Objectives-Productivity), which is based on the theory of systems.

As per this model, Productivity Index (PI) of a system can be arrived at as,

$$PI = \sum_{u=1} \sum_{v=1} \sum_{y=1} W_u \cdot W_{vu} \cdot W_{yvu} \frac{O_{yvu}}{O_{yvu}^*}$$

where u = Sub-system

v = Key Performance Area (KPA)

y = Performance Objective

W = Weightage factor

$O_{yvu}$  = The actual value of PO<sub>-y</sub> of KPA<sub>-v</sub> Sub-system u.

$O_{yvu}^*$  = The Objectivated Output of PO<sub>-y</sub> of KPA<sub>-v</sub> of Sub-system u.

The Objectivated Output has been defined as the optimal level output which is possible to be attained by a system (sub-system) under the given constraints of input resources and a set of performance objectives.

### Integrating BPR and Productivity

Since the start of this century, productivity and its many facets have been in the limelight. Firstly, the increased demand on production brought the emergence of concepts and practices of scientific management followed by approaches based on business relations and behavioural scientists. Increased competition made the customer realise his role in the market. This resulted in management approaches which focused on customers to provide better quality and service (TQM, JIT etc.). Globalisation and liberal economic reforms have now ushered in an era of multilateralism. To meet these challenges focus has now shifted to the various facets of productivity: cost, quality, service and speed. Factorial productivities carry limited appeal. Total productivity or the system productivity of an organisation matters the most as the stakeholders are basically interested in the overall performance of the organisation. Productivity management aims at enhancing the productivity of an organisation and follows sequential steps of planning and organisation, measurement, evaluation implementation and monitoring (Prem Vrat *et al*, 1998). It follows a closed loop cycle. BPR recommends similar stages to bring about improvement in the system. It calls for thorough analysis of the goals of the organisation; it seeks to identify the key areas of action (processes); it requires establishing potential gaps; it recommends measurement of performance before and after the ac-

**Globalisation and liberal economic reforms have now ushered in an era of multilateralism. To meet these challenges focus has now shifted to the various facets of productivity: cost, quality, service and speed.**

tion plan and implementation of re-engineered process. BPR lays a heavy stress on parameters of cost, quality, service and speed while selecting key processes. These parameters are also the essential dimensions of KPA's while measuring productivity.

BPR and KPA have the following features:

- Both the concepts emphasize that organisation should be viewed as a unified whole. Functional performance has limited appeal and can sometimes mislead. Financial or factorial productivity ratios do not help in identification of improvement opportunities, except in limited applications.
- Both require a thorough understanding of business mission, goals and policies.
- Identification of key processes for re-engineering has been suggested as a major exercise under BPR. System productivity (PO-P) approach has proposed identification of sub-systems and KPA's.
- Process attributes and measures of performance are required to be selected under BPR. Performance objectives is the terminology used PO-P approach.
- BPR focuses on dramatic improvement opportunities.
- Furthermore PO-P approach goes very elaborate on establishment of targets for potential performance and of 'objectivated output' optimal level of attainable performance. PO-P approach has detailed a methodology to arrive at Objectivated Output through techniques such as 'Nominal Group Technique (NGT), benchmarking and goal programming to resolve conflicts (Sardana and Prem Vrat, 1987). Ranking and prioritisation of the objectives is again common to both approaches (Sardana and Prem Vrat, 1987).

### Conclusions

BPR has emerged as one of the most important management concepts to meet the new challenges of competition. It is particularly useful for large organisations which have created barriers of work culture based on the supremacy of functional departments or task orientation. BPR stresses on customer focus in particular and recommends re-engineering of the process so as to provide more value to the customers. Dramatic improvement and extensive use of IT are the major distinguishing features of BPR.

BPR is closely integrated with productivity management. Both emphasize on wholeness of the organisation. There is a clear departure from an approach based on functional management. Both attach significance to select key processes or performance areas with a high potential for performance. BPR is an important tool to improve the productivity of an organisation.

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## The Stages and Tasks of Re-engineering

### Preparation

- Recognise Need
- Develop Executive Consensus
- Train Team
- Plan Change

### Solution: Technical Design

- Model Entry Relationships
- Process Linkages
- Instrument and Informate
- Consolidate Interfaces and Information
- Redefine Alternatives,
- Redefine and Retime Controls
- Modularise
- Specify Deployment
- Apply Technology
- Plan Implementation

### Transformation

- Complete Business System Design
- Perform Technical Design
- Develop Test and Roll-Out Plans
- Evaluate Personnel
- Construct System
- Train Staff
- Pilot New Process
- Refine and Transition
- Continuous Improvement

### Identification

- Model Customers
- Define and Measure Performance
- Define Entities
- Model Processes
- Identify Activities
- Extend Process Model
- Map Organisation
- Map Resources
- Prioritise Processes

### Vision

- Understand Process
- Understand Process Flow
- Identify Value-Adding Activities
- Benchmark Performance
- Determine Performance Drivers
- Estimate Opportunity
- Envision the Ideal
- Integrate Visions
- Define Sub-Visions

### Solution: Social Design

- Empower Customer Contact Personnel
- Identify Job Characteristic Clusters
- Define Jobs/Teams
- Define Skills and Staffing Needs
- Specify Management Structure
- Redraw Organisational Boundaries
- Specify Job Changes
- Design Career Paths
- Define Transitional Organisation
- Design Change Management Programme
- Design Incentives
- Plan Implementation



# Long-Range Planning Model for the Indian Coal Industry

Chandan Bhar and S. Srinivasan

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*An attempt has been made herein to develop a long-range planning model for the coal industry using system dynamics methodology. The model has been developed by using the DYSMAP2/386 syntax. This model has been calibrated and validated using the historical data. The sensitivity analysis has also been carried out for certain key parameters of the model. The model has been simulated using DYSMAP2/386 compiler to generate the performance of the coal industry for 15 years, from 1990 to 2005. This model can be used for testing various policies for identifying suitable strategy for healthier growth of the industry.*

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## Introduction

Coal is one of the principal sources of energy in India in large number of industrial sectors. It has been observed during the Sixth and Seventh Five Year Plans of India that the pit head stock mounted to over 30 million tonnes during March 1985 (Bar and Mandal, 1990). There was a lack of coordinated approach to the management of production, movement, consumption, and stock of coal (Planning Commission, 1979 & 1985). Moreover coal industry is a capital intensive industry. Any over-optimistic demand projection will cause an inventory build-up, leading subsequently to an under utilization of the capacity and the scarce resources. It is therefore, necessary that future estimates of coal demand and coal availability are made realistically and very carefully. To be able to make these estimates, the right methodological framework is necessary.

A methodological framework is suggested, wherein there are two requirements: (1) collecting quantitative data on various aspects of the industry available for the past years, (2) building a dynamic model for long-range planning.

On the basis of the analysis of the various management science tools and the nature of the problems of the coal industry, it has been decided to develop a system dynamics model for the local industry.

The system dynamics model incorporating the curve fitting models for forecasting price of coal, and coal consumption and also the regression models for forecasting coal production, social overhead expenditure, and cost of production have been developed. This system dynamics model can be used to develop the long-range plan for the coal industry.

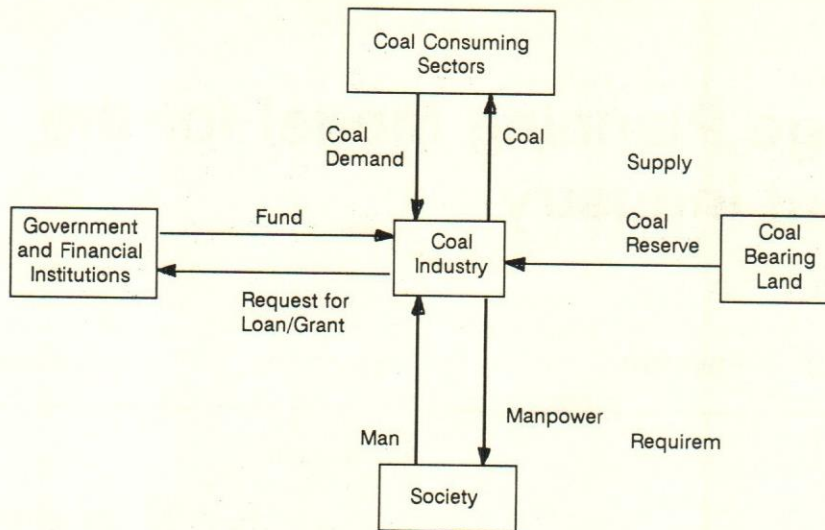


Fig .1. Overview Diagram of the Coal Industry

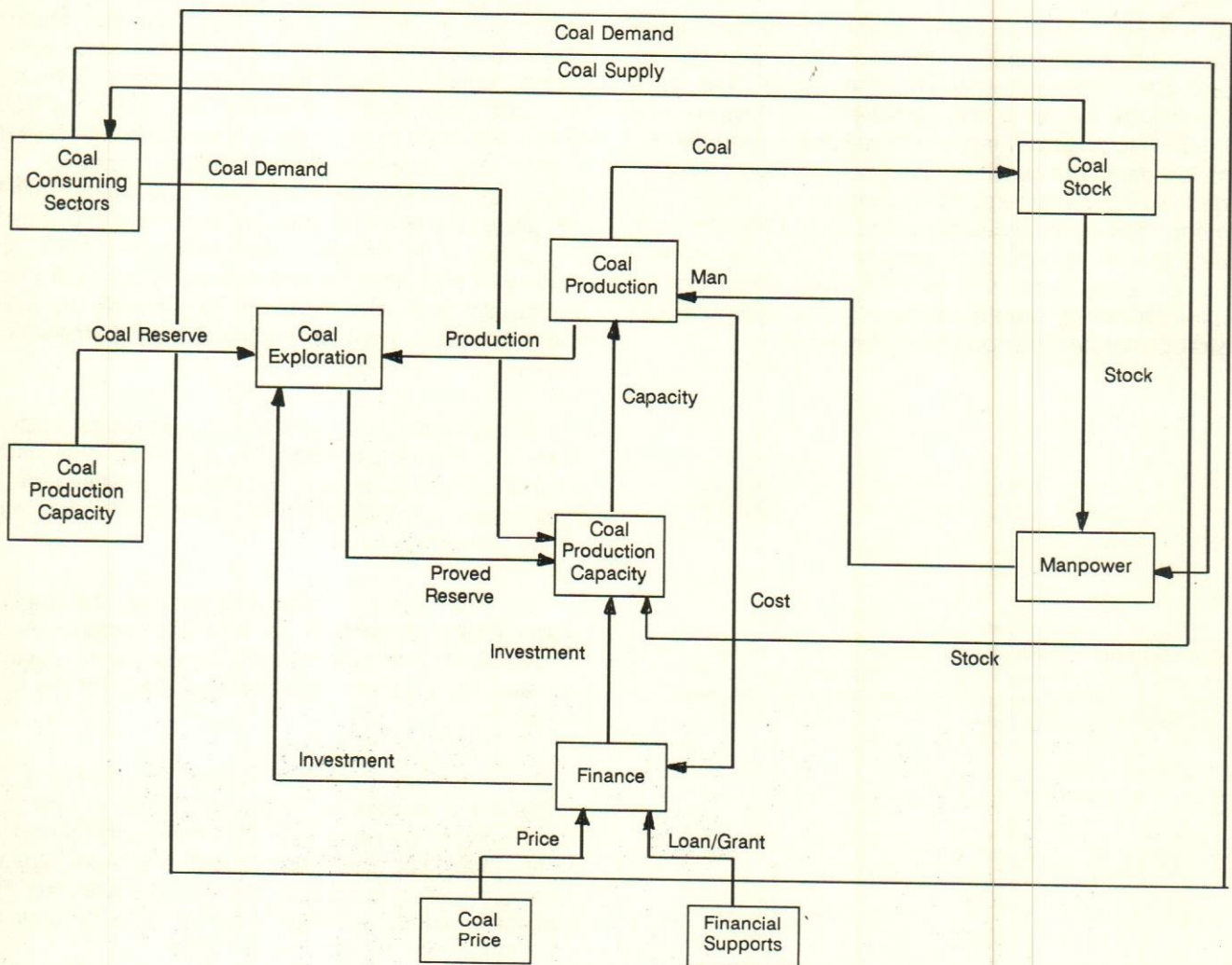


Fig. 2. Sectoral Overview Diagram for the Coal Industry

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## Coal Industry Model

### **Structure and Overview of the Coal Industry Model**

From the overview diagram of the model presented in Fig. 1, it is seen that the industry receives the coal demand and it supplies coal to the consuming sectors. The industry receives the loan/grant from the Government and the financial institutions against the request made by the industry. The society supplies manpower to the industry to fulfill the manpower requirements and the coal reserves are received by the industry from the coal bearing land.

### **Sectoral Overview Diagram of Overall Coal Industry Model**

The details of the sectoral overview diagram (Fig. 2) of the overall coal industry model is presented below.

#### *Coal production sector*

The coal production is dependent on manpower, and the coal production capacity. The coal production in turn affects the coal stock, exploration, and the investment of the coal industry.

#### *Coal consumption sector*

The consumption of coal decides the coal production capacity and the manpower requirements of the coal industry.

#### *Coal capacity sector*

The coal production capacity determines the coal production and is affected by the coal exploration, investment, the coal stock of the industry, and the consumption by the coal consumption by the coal consuming sectors.

#### *Coal exploration sector*

The coal exploration is dependent on coal production, coal reserve available for exploration, and also on the finance available for exploration. The exploration rate, in turn, affects the new coal capacity acquisition.

#### *Coal stock sector*

The coal stock is affected by the production and the consumption of coal. The coal stock, in turn, influences the coal capacity acquisition and the manpower requirement of the industry.

#### *Manpower sector*

The manpower requirement is decided by the forecasted coal consumption along with the available coal stock, and it influences the future coal production.

#### *Finance sector*

The investment in the coal industry is dependent on coal production, coal price, and financial support provided by the government and other agencies. The investment decides the coal capacity acquisition and the coal exploration.

### **Model Development**

The system Dynamics model for the coal industry has been developed by using the DYSMAP2/386 syntax (University of Salford). The model consists of 125 DYSMAP equations. The model is divided into nine sectors. These sectors are listed below:

- Coal Consumption
- Coal Exploration
- Capacity Acquisition
- Manpower
- Coal Production
- Coal Stock
- Finance
- Assets and Loans
- Financial Ratios

### **Calibration & Execution**

The system dynamics model developed in the earlier section has been calibrated with the help of historical data for the period from 1975-1985 collected from the various published documents, technical papers, and reports published by various agencies like Coal India Limited, Planning Commission, Bureau of Industrial Costs and Prices etc.

The model has been simulated for 5 years, i.e., from 1985 to 1990 by using the DYSMAP2/386 package in PC-486 computer and the results are then compared with the actual data for the same period for the purpose of validation. The validated model is then simulated for 15 years, i.e., from 1990 to 2005, to generate the future scenarios of the coal industry. A simulation time interval (DT) of 0.25 years is assumed.

## Model Validation

### Qualitative Tests

The model has been simulated for five years, i.e., from 1985 to 1990, and the model generated values for a number of important variables are compared with their actual values. The model generated values and the actual values of a number of important variables for the said period are presented in Figs. 3 through 6. It can be seen from these figures that the model generated values match reasonably with actual values of real life.

### Quantitative Tests

In order to increase the confidence on the model, a quantitative test has also been conducted to validate the model (Chowdhury, 1991). In this test, The root mean square percentage error between the model generated values and actual values of the important variable have been computed.

**Table 1:** Percentage Root Mean Square Error of the Important Variables

Name of the Variables	Root mean square percentage error (%)
Coal production (CPR)	3.37
Total capital employed (CTL)	3.17
Total manpower (TMAN)	1.73
Total desired investment (TDINV)	5.53
Labour productivity (PR)	0.07
Price of coal (PRIC)	5.38
Cost of production (COST)	5.48
Coal consumption (CD)	1.50
Equity (EQTY)	1.95
Loan (LOAN)	3.06
Total revenue (TREV)	5.40
Total expenditure including interest (TEXPI)	6.21
Total assets owned (TOWN)	7.86
Net loan (NLOAN)	3.43
Coal stock (STOCK)	11.93
Cumulative profit/loss	13.22
Debt equity ratio (DERAT)	8.18

The percentage root mean square error between the model generated values and the actual values of the important variables are presented in Table 1. It can be seen from Table 1 that for most of the important variables of the model the root mean square percentage error is well below 10 per cent and for only two variables it has exceeded the 10 per cent mark.

Considering the outcomes of the qualitative test as well as the quantitative test, it can be said that this system dynamics model is a valid representation of reality and can be used for studying the behaviour of the coal industry.

### Model Behaviour (The Standard Run)

The system dynamics model of the coal industry has been simulated for 15 years, from 1990 to 2005. The outcome of this standard run is presented in Figs. 7 through 10.

Figure 7 shows that the total coal consumption (CD) will grow at a very fast rate and the total coal consumption, which was 184.94 million tonnes at the beginning of 1990, will reach 457.24 million tonnes in the year 2005. The coal production (CPR) will also increase at a fast rate and will reach the 465.06 million tonnes figure in the year 2005. Similarly, the coal stock (STOCK) will rise to 82.79 million tonnes in the year 2005 from 36.62 million tonnes in the year 1990.

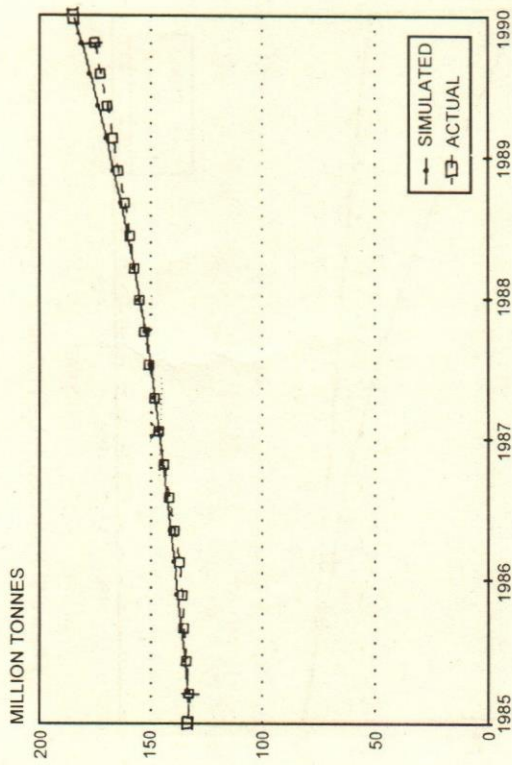
It can be seen from Fig. 8 that the total manpower of the coal industry will increase steadily from 0.65868 million in the year to 0.902 million in the year 2005. Figure 8 also shows that the labour productivity (PR) will reach 2.30 tonnes of coal per man-shift in the year 2005.

Figure 9 shows that the price of coal (PRIC) will rise at a very slow pace and will reach Rupees 288.56 per tonne in the year 2005. Figure 9 also shows that the rise in cost of production (COST) will be very fast and will reach the Rupees 453.29 per tonne figure in the year 2005.

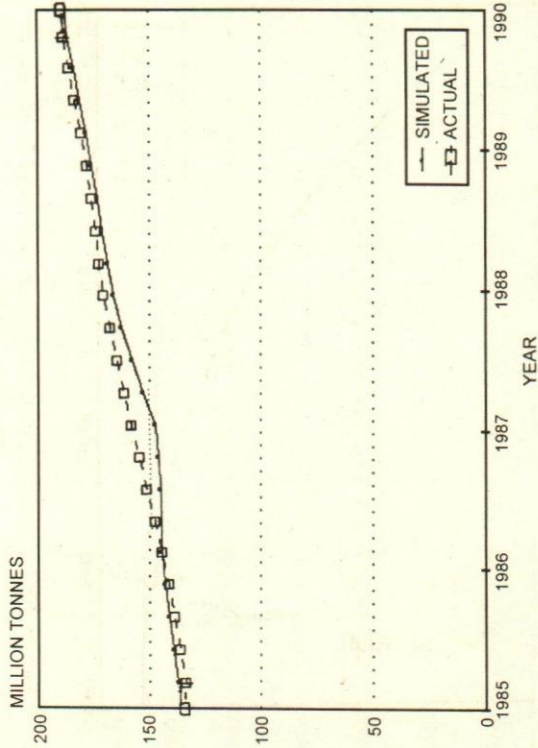
Figure 10 presents the desired investment (TDINV) and the borrowing of fund (BORROW). This figure shows that the rate of growth in fund borrowing will be much higher than the rate of growth in the desired investment. The desired investment (TDINV) will be Rupees 27,145 million and borrowing of fund (BORROW) will be Rupees 121,000 million in the year 2005. This figure also shows that the borrowing of fund (BORROW) is always more than the desired investment (TDINV). This happens because of very low profit and very high amount of loan in the coal industry.

### Future Projections

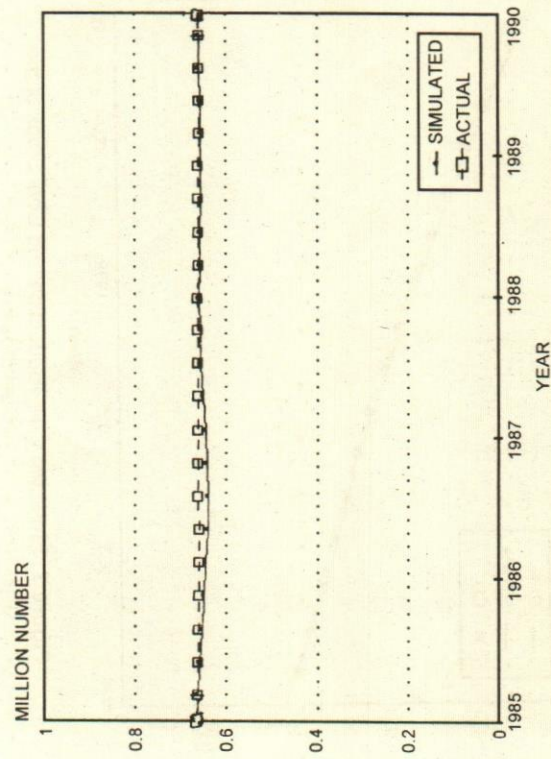
The values of the key variables generated by the model are now compared with the future projections made in the Corporate Plan of the Coal India Limited 1990-91 to 1994-95 (Coal India, 1991).



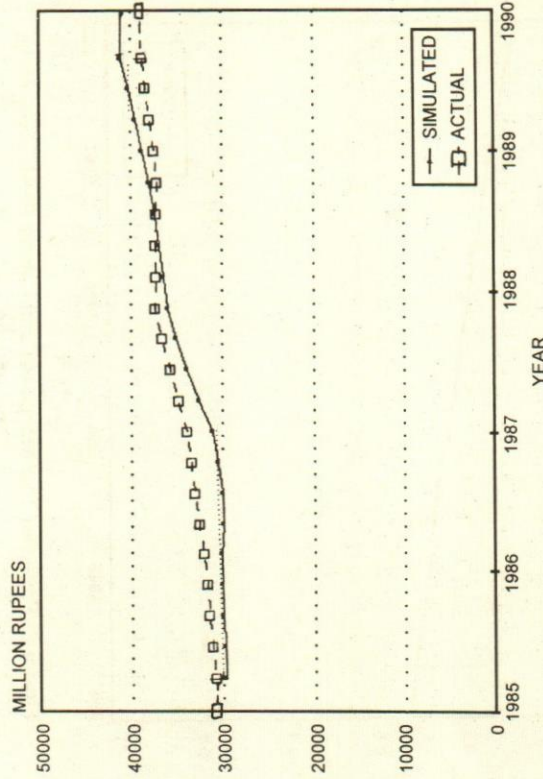
**Figure 3:** Comparison between the Simulated and Actual Coal Consumption



**Figure 4:** Comparison between the Simulated and Actual Coal Production



**Figure 5:** Comparison between the Simulated and Actual Total Manpower of the Coal Industry



**Figure 6:** Comparison between the Simulated and Actual Total Expenditure

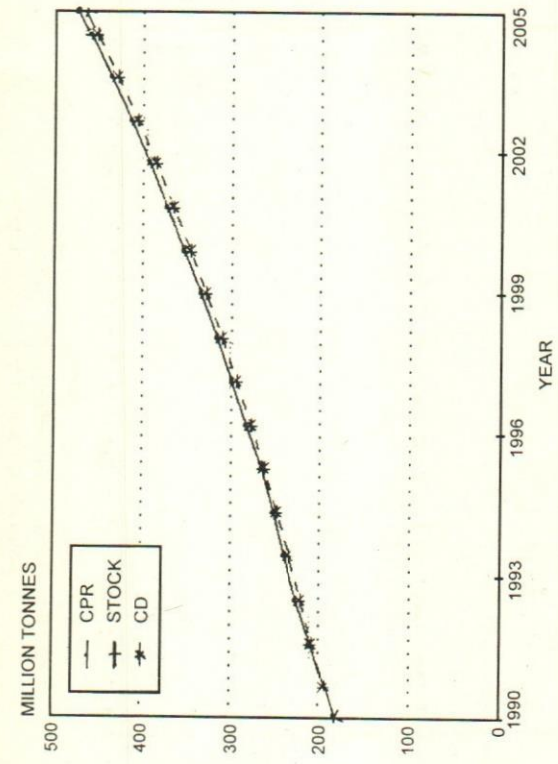


Figure 7: Projected Coal Production and Coal Stock of the Coal Industry

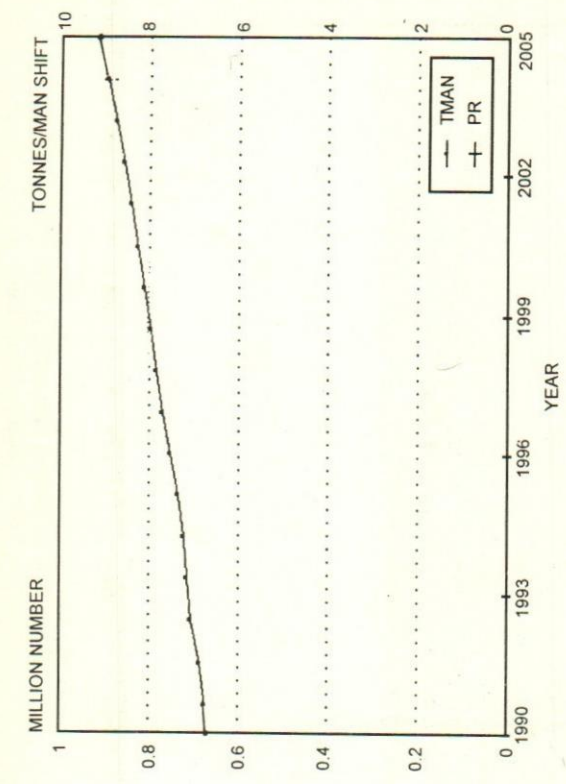


Figure 8: Projected Total Manpower and Labour Productivity of the Coal Industry

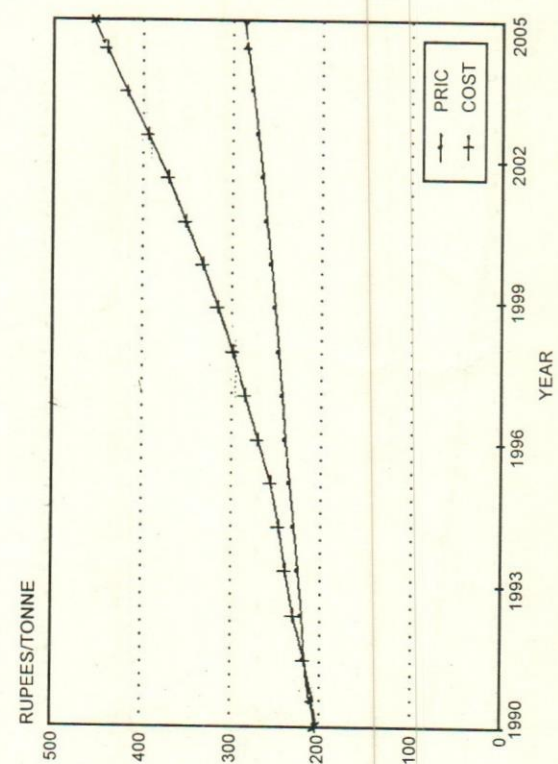


Figure 9: Projected Price of Coal and Cost of Production

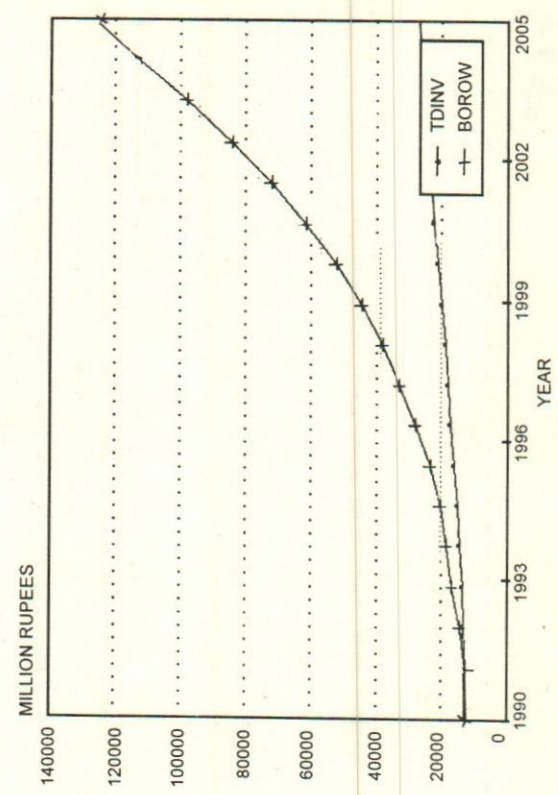


Figure 10: Projected Desired Investment and Fund Borrowing of the Coal Industry

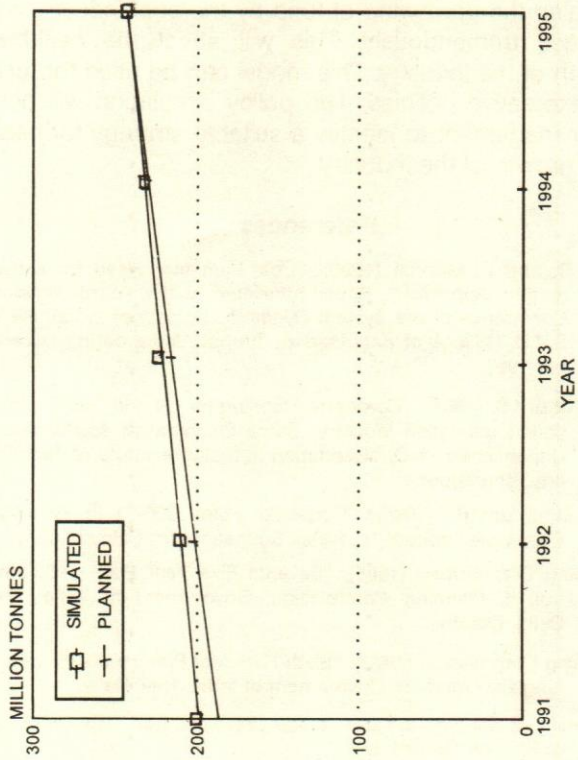


Figure 11: Comparison between the Planned and Simulated Coal Consumption

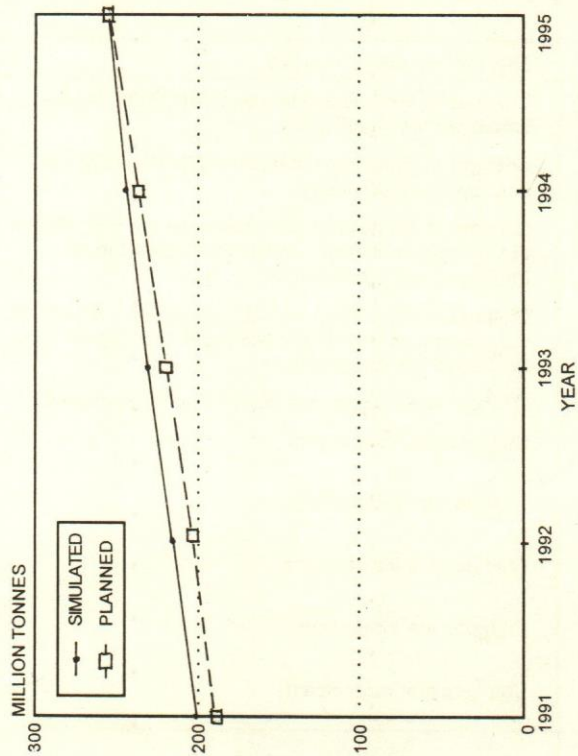


Figure 12: Comparison between the Planned and Simulated Coal Production

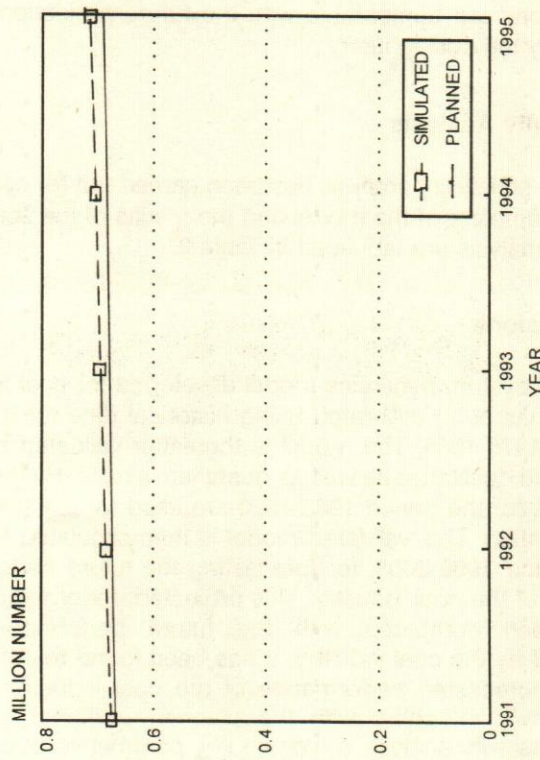


Figure 13: Comparison between the Planned and Simulated Total Manpower

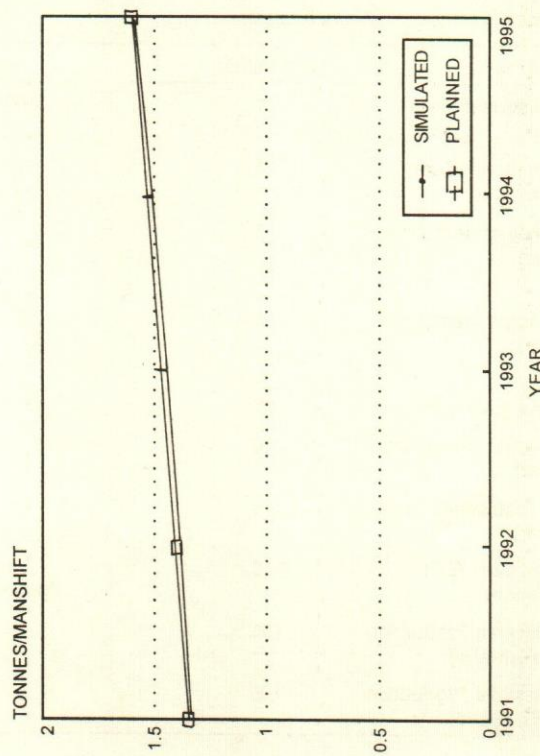


Figure 14: Comparison between the Planned and Simulated Labour Productivity

**Table 2: Results of the Sensitivity Analysis**

Variable Name	Old Value	New Value	Effect of Sensitivity Analysis
Hiring Adjustment Time (HAT) (year)	1	3	Changes in Production, Manpower, Net Profit, Capital Employed are significant.
Hiring Adjustment Time (HAT) (year)	1	5	Changes in Production, Manpower, Net Profit, Capital Employed are significant.
Capacity Adjustment Time (CAT) (year)	5	1	Changes in Production and Manpower are insignificant but changes in Investment, Net Profit and Capital Employed are significant.
Capacity Adjustment Time (CAT) (year)	5	3	Changes in Production and Manpower are insignificant but changes in Investment, Net Profit and Capital Employed are significant.
Life of Mine (LM) (year)	20	25	Changes are insignificant except Capital Employed.
Capacity Acquisition Delay (CAD) (year)	10	12	Changes are insignificant
Capacity Acquisition Delay (CAD) (year)	10	12	Changes are insignificant
Exploration Cost (EC) (Rupees/tonne)	0.15	Function of Reserve Life Index	Changes are insignificant
Desired Reserve Production Ratio (DPR) (Ratio)	195	225	Changes are insignificant
Desired Reserve Production Ratio (DPR) (Ratio)	195	175	Changes are insignificant

Figures 11 through 14 compare the model generated projections and future projections made by the coal industry, in respect of coal consumption, coal production, total manpower, and labour productivity. It can be seen from the figures that the model generated projections are comparable with the future projections made by the coal industry.

### Sensitivity Analysis

The sensitivity analysis has been carried out for certain parameters of the model and the results of the sensitivity analysis are tabulated in Table 2.

### Conclusions

The system dynamics model developed for coal industry has been calibrated using historical data for the period 1975-1985. The model is thereafter validated by using the qualitative as well as quantitative tests. Historical data for the period 1985-1990 are used for the sake of validation. This validated model is then simulated for the period 1990-2005, for forecasting the future performance of the coal industry. This projected performance has been compared with the future performance planned by the coal industry. It has been found that the model forecasted performance of the coal industry is reasonably matching with the planned performance. The sensitivity analysis of certain key parameters of the

model has also been conducted. This has increased the acceptability of the model.

The projected performance for the coal industry for the period 1990-2005 shows that the cost of production and also the borrowing of fund by the coal industry will increase tremendously. This will affect the healthier growth of the industry. This model can be used for testing alternative policies. The policy simulation will help the management to identify a suitable strategy for healthier growth of the industry.

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# Downsizing Versus Contract Labour System

E.M. Rao

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*Downsizing has thrown up more number of problems than it has solved. With the "muscle going leaving the fat behind", employers engage contract workers make up the shortfall, which is snow-balling into a different set of problems. The recent decision of the Supreme Court in the Air India case serves as a significant point of departure. The term 'abolition' has been interpreted to imply 'absorption' of contract workers in the regular service of principal employer. This judgment applies to all establishments, and admits no exception. Contract workers engaged in skilled categories have gained a strategic advantage by virtue of working in key operations. In addition, the regular trade unions are admitting them as members and demanding their absorption in permanent service. Some concession to unions is becoming imperative to maintain industrial peace and harmony. This raises the more basic question, "whither all this downsizing exercise?"*

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## Introduction

The issue of contract labour has assumed critical dimensions in the recent past. Principal employers are caught in the cross-fire between government notifications abolishing 'contract labour' in several employments and the internal demand from unions to absorb contract workers in regular service. At a time when the industry is preoccupied with massive downsizing programme at all levels of organisational hierarchy, the demand for regularisation is somewhat a difficult proposition to swallow. The magnitude of the problem can be gauged from the fact that, in a two-day national seminar held in Visakhapatnam in June, 1997 on Human Resource Management Competencies, the two major concerns of personnel professionals were "how to reduce the fat?" and "how to cope with the demand for absorption of casual/contract workers in a situation like this?"

## The Problem

Downsizing has thrown up more number of problems than it has solved. Particularly, in the 'workmen' category, the issue has assumed serious proportions due to the fact that in almost all cases, "the fat remains while the muscle goes." This has placed many organisations in a 'catch-22' situation to the extent that this 'muscle-drain' has an adverse impact on productivity and quality. To make up for the shortfall, casual and contract workers are being employed generously even on skilled/technical jobs of permanent and perennial nature, which is snow-balling into an altogether different set of problems. The situation has already assumed a highly complex character in many organisations. The following factors may probably throw some light on the issue:

- The unionisation of contract workers, which was on a low-key for a long time, has gained greater momentum in the post-liberalisation era.
- The State/Central governments have been abolishing contract labour system in several

operations, which were traditionally being manned by contract workers.

- There is a continuous skill-drain due to the Voluntary Retirement Scheme and other modes of attrition.
- The residual permanent workers either do not possess matching skills or are undisciplined and tardy, leading to a fall in productivity and quality.
- Contract workers (casual labour included) gained a definite strategic advantage and greater bargaining power by virtue of being employed in key operations, which were hitherto carried out by regular workers.
- Employers are finding it difficult to dispense with contract workers as they supply the much-needed 'productivity-gap' created by the permanent 'low-producers'.
- The decisions of Supreme Court during the past one decade have been consistent, but with a clear tilt in favour of regularising the contract workers in the permanent service of the principal employer.

As early as 1931, the Royal Commission on Labour recommended the abolition of contract labour system which was then rampant in textile and mining industries. The Bombay Textile Labour Enquiry Committee (1940) observed: "if the management of the mills does not assume responsibility for such labour, there is every likelihood of its being sweated and exploited by the contractors," and recommended abolition of the system. The Bihar Labour Enquiry Committee came to a similar conclusion shortly thereafter.

With the adoption of 'Welfare State' and 'Socialism', the Government initiated certain measures to ameliorate the working conditions of contract labour. More particularly, the definition of 'worker' in the Factories Act, 1948, Plantation Labour Act, 1951, and Mines Act, 1952, was enlarged to include contract workers, so that the beneficial aspects of law would apply to them. In fact, the major breakthrough in this direction came when the Dock Workers (Regulation of Employment) Act, 1948 was enacted, incorporating express provisions to protect the wages and welfare conditions of certain specified categories of contract labour employed at major ports.

### Working of Contract Labour

Contract labour system is a universal phenomenon and is by no means unique to our country. The system is replete with a multitude of malpractices. To illustrate,

**The contractors are, in most cases, either fictitious or the *de facto* employees of the principal employer, operating as contractors and claiming a distinct legal entity.**

the contractors are, in most cases, either fictitious or the *de facto* employees of the principal employer, operating as contractors and claiming a distinct legal entity. It is a common practice that both the contractor and his workers re-incarnate at regular intervals in different names. This creative exercise is meant to prove that the workers are not employed under the 'same' contractor continuously and are, hence, not entitled to certain service and other benefits. Even the educated workers are asked to use their left-hand thumb impression, and not signature, while granting receipt for wages. The entire system stinks to the point of disgust and is a transparent commentary on the degenerating human values. Some of these acts are indeed culpable.

A recent study conducted on contract labour in the construction industry covering five major Indian cities, namely: Mumbai, Delhi, Pune, Hyderabad and Visakhapatnam, reveals a very interesting trend. It was found that the construction industry accounts for about 16 per cent of India's working population. During the period 1981-91, the rate of growth of employment in construction was over 7 per cent per year against the national average of 2.3 per cent. It was found that in 1995-96, of the estimated number of 12.9 million construction workers in India, 10.7 million were contract workers. Those under 18 years of age varied from 5 per cent in Mumbai to 22 per cent in Visakhapatnam (Vaid, 1997).

**During the period 1981-91, the rate of growth of employment in construction was over 7 per cent per year against the national average of 2.3 per cent.**

Another study conducted on the contract labour system in public sector revealed that the proportion of contract workers increased from 1.9 per cent in 1980-81 to 3.10 per cent in 1989-90 in the public sector, whereas the increase in private sector was from 6.1 per cent to 13.5 per cent during the same period. It was also found that, in most cases, the contract workers in public sector earn 40-70 per cent lower wages than that of the regular workers, do not have service benefits like P.F., E.S.I., gratuity, etc., and do not have job security.

## Causes for Contracting Labour

There are many reasons for employers resorting to such measures. But, the argument that contract labour is cheaper in terms of wages (costs) is true only in part. Contract workers engaged in the 'general' and other 'unskilled' job are paid less than permanent workers. In respect of other categories, the position is different. For instance, the wages of 'skilled' and 'highly skilled' technicians are determined on the basis of their proficiency and the availability/scarcity of particular skills in a given locality or industry. In fact, some of the highly skilled technicians for example, welders, plumbers, millwright mechanics, carpenters, masons and the like even dictate terms to the contractor and, through him, to the principal employer. These workers enjoy higher degree of mobility and are paid hefty wages as against their permanent counterparts. In these cases, the saving in indirect costs is, often, more than offset by higher direct compensation.

**Some of the highly skilled technicians dictate terms to the contractor and, through him, to the principal employer.**

The above facts do not fully explain the problem and the core questions remain unanswered. Given that the benefit in monetary terms is either nil or marginal, what else could be the reason for continuing with the system? A convergent analysis leads one to turn his attention to two important aspects, namely, (a) the impact of legislative provisions on employment relationship, and (b) issues relating to flexibility in carrying out business activities.

The *restrictive job security regulations* (for example, the Chapter V-B of the ID Act, 1947), which make it practically impossible for an employer to terminate the services of his permanent workmen—and, in certain circumstances, even temporary workers and probationers—seem to be one major cause. Myopic legislation coupled with judicial activism produced its own antithesis in a host of undesirable side effects. More specifically, the 'ultra-radical' approach adopted by the courts, starting from the *Sundaramoney's* case, (Supreme Court, 1976) can be cited as the single major factor responsible for this state of affairs. Nothing perhaps is more nightmarish for an Indian employer than the very thought of 'permanent' workmen on his rolls. Once they get in and/or are confirmed, he is stuck with them forever. If his enterprise is 'large enough' to employ 100 or more workmen, then

the position is still worse. If a workman completes 240 days of continuous service, either by design or by default, the employer has to pay for it heavily. Law and justice have left no civilised exit route for employers.

**Nothing perhaps is more nightmarish for an Indian employer than the very thought of 'permanent' workmen on his rolls. Once they get in and/or are confirmed, he is stuck with them forever.**

Secondly, the *need for operational flexibility*, i.e., the degree of ease and speed with which an employer can shift his workers from one operation to another or require them to perform more than one function, often travelling beyond job descriptions, is another major factor. Collective agreements (procedural) and job descriptions—which are often the creation of employers—turned out to be 'rigid instruments' detrimental to the very interests of employers themselves, in the context of a fast changing environment that calls for quick adaptation as a necessary pre-requisite for survival in a global market. *Small wonder, most entrepreneurs look at 'permanent' workforce more as a 'nuisance', than as a 'resource', notwithstanding the 'surface euphemism' represented by labels, such as, Human Resource Management.* The proliferation and exploitation of contract labour as well as the simultaneous shrinkage in permanent cadres can be largely explained by these trends.

## Judicial Review

It is in this backdrop that, the objects sought to be achieved by the Contract Labour (CL) Act, its failure to suppress the mischief and advance the remedy, the amount of litigation it gave rise to and the evolution of judicial thought over time, need to be considered. For the sake of convenience, this aspect will be examined in terms of the following issues:

- Pre-legislation judicial measures.
- Constitutional validity of the CL Act, 1970.
- Effect of non-compliance with Ss. 7 & 12 of the Act.
- Status of contract workers on the abolition of the system.
- 'Absorption' even without a formal abolition of the system—conditions.

- Change in judicial thought—'abolition' means/implies 'automatic absorption'.

#### *Pre-legislation judicial measures*

Long before the enactment of the CL Act, the Supreme Court considered the issue of contract labour system in the *Standard Vacuum Refining Company* case (Supreme Court, 1960). The court laid down the following guidelines governing the contract labour system, and peremptorily held that the practice of employing contract labour should be discouraged, when the work is:

- perennial and must go on from day-to-day;
- incidental and necessary for the work of the factory;
- sufficient to employ a considerable number of whole-time workmen; and
- done in most concerns through regular workmen.

Following the above guidelines, the Supreme Court in the case of *National Iron & Steel Company* (Supreme Court 1967), affirmed the decision of Industrial Tribunal abolishing contract labour practice in one of the units, i.e., the Tata Nagar Foundry Co., Ltd., excepting in certain non-perennial operations. Thus, even before the birth of the CL Act, the courts applied the quadruple test enunciated in *Standard Vacuum* case to determine whether, in a given operation, contract labour system should be abolished or not. The Parliament incorporated the above guidelines in S. 10 of the Act.

#### *CL (R & A) Act, 1970*

The constitutional validity of this Act was upheld by the Constitution bench of the Supreme Court in *Gamon India* case (Supreme Court 1974).

#### *Effect of non-compliance with Act*

One basic issue that came up for decision before several High Courts was the nature of consequences that flow out of *non-registration by the principal employer* (S. 7) and *non-possession of a valid license by the contractor* (S. 12). In *Food Corporation of India* case (Kant, 1986), the Karnataka High Court held that in the absence of a certificate of registration by the corporation provided under the Act to employ contract labour, the workmen of the contract labour will be considered to be the workmen of the principal employer. In (*Best & Crompton* case, 1985), the Chennai High Court

held that the workmen engaged by the contractor working for management, without holding valid license would be workmen engaged by the management itself. The High courts of Punjab and Haryana (1988) and Bombay endorsed this view.

More specifically, in *United Labour Union* case (Bombay High Court 1991), it is observed that there could be no deemed contract labour because the contractors did not have a valid license for the work of sweeping and cleaning the premises of Air India, and as a result the workmen become the employees of the principal employer. Dealing with this issue in the case of *Dena Nath v. National Fertilisers Ltd.* (Supreme Court 1992), a two-judge Bench of the Supreme Court held that no such conclusion could be drawn, and that the High Court, in exercise of its power under Art. 226, had no power to direct absorption of the contract labour as the direct employees of the principal employer. It was further held that *the only consequence of such non-compliance was exposure to prosecution*. The employers heaved a sigh of relief as a consequence of this decision, which expressly overruled all earlier decisions, to the contrary, rendered by various High Courts.

#### *Status of contract workers on the abolition of CL system*

In the Karunakaran's case (Kerala High Court 1989), and in APDDCF case (AP High Court, 1989), held that under the Contract Labour Act, *there is no provision that the employees of the contractor become the direct employees of the employer on the termination or abolition of the labour contract*.

In *Gujarat Electricity Board* case (Supreme Court 1995), a two-judge Bench expressed its disenchantment with the legislation as it did not provide for determining the status of the ex-workmen of contractor, once the appropriate government abolishes the contract labour. Having said that much, the court proceeded to lay down a highly cumbersome procedure for raising an industrial dispute against the principal employer either by the erstwhile contract workers themselves or, in the alternative, by the direct workmen of the principal employer for absorption of the said ex-contract workers.

#### *'Absorption' even without a formal abolition of the system—conditions*

Several cases have been reported, wherein the contract workers engaged in 'public undertakings' availed the writ jurisdiction of High Courts and the Supreme Court and sought relief in the form of absorption in the permanent service of principal employer. In most of these

cases, it has been observed *there was no formal abolition of the contract labour system* by the appropriate government under S. 10 of the CL Act. Nevertheless, the courts have entertained the writ petitions and ordered abolition of contract labour, subject to the condition that the operations/activities, in which contract workers were engaged, satisfy the quadruple test laid down in the *Standard Vacuum* case (supra) and incorporated in S. 10 of the CL Act. The undertakings affected include railways, public sector undertakings, Life Insurance Corporation of India, and other corporations.

In the case of *Catering cleaners of Southern Railway* (Supreme Court, 1987), Court held that it can issue a writ of *mandamus* directing the central government to exercise its powers u/s. 10(1) and (2) of the CL Act. The court further ordered that "a decision should be taken within three months failing which, the Southern Railway administration will, within three months thereafter, absorb the contract workers into their service and regularise their services." In *R.K. Panda v. Steel Authority of India* (Supreme Court, 1994), the court ordered that all those contract workers working for the past 10 years be absorbed in the permanent services of the company.

In a writ petition filed under Art. 14 (Equality before law) of the Constitution in *Parimal Chandra Raha and Ors. v. LIC of India and Ors.* (Supreme Court 1995), court held that contract workers employed in the canteens attached to the offices of the Corporation were entitled to the relief of their absorption in the service of the Corporation were entitled to the relief of their absorption in the service of the Corporation as its regular employees and also to pay as is paid to other employees of the Corporation. (Note: In these cases, no formal notification was issued by the appropriate government abolishing contract labour system in the respective operations/ activities).

*Change in judicial thought—'abolition' means/implies 'automatic absorption'*

In an appeal filed by the *Air India Statutory Corporation* (Supreme Court, 1997) against the decision of Bombay High Court, a larger Bench of Supreme Court upheld the decision of Bombay High Court (supra) and overruled the earlier decision of SC rendered in *Dena Nath's* case (supra). The court framed the following issues, namely:

- What would be the consequence that ensue from abolition?
- Does the Act intend to deny the workman the right to continue to work?
- Or does it intend to denude him of the benefit of permanent employment? and

- If so, what would be the remedy available to him?"

The court addressed the issues as follows:

1. "It is true that we find no express provision in the Act declaring the contract labour working in the establishment of the principal employer in the particular service to be the direct employees of the principal employer... Similarly, when the appropriate government finds that the employment in of perennial nature etc., contract system stands abolished, thereby, it intended that if the workmen were performing the duties of the post which were found to be of perennial nature on par with regular service, *they also require to be regularised. The Act did not intend to denude them of their source of livelihood and means of development, throwing them out from employment...*" (para. 53, p. 1145). (emphasis added).

The court concurred with two of its earlier decisions, namely, (i) in *Sankar Mukherjee's* case (Supreme Court, 1990), and (ii) in *National Federation of Railway Porters, Vendors & Bearers' case* (Supreme Court, 1995), wherein the employers were directed to regularise the contract workers in permanent service. The court finally held:

2. "... on abolition of the contract labour system, by necessary implication, the principal employer is under statutory obligation to absorb the contract labour. The linkage between the contractor and the employee stood snapped and direct relationship stood restored between the principal employer and the contract labour as its employees. Considered from this perspective, all the workmen in the respective services working on contract labour are required to be absorbed in the establishment..." (para. 61, p. 1149). (emphasis added).

**On abolition of the contract labour system, by necessary implication, the principal employer is under statutory obligation to absorb the contract labour.**

#### Evaluation & Conclusions

1. The Contract Labour Act was implemented by the 'appropriate' governments in a half-hearted manner during the past two-and-half decades.

The enforcement was so ineffective that the legislation has not only failed to suppress the mischief and advance the remedy, but, even worse, successfully achieved the opposite. In most cases, the contract workers are not paid minimum wages nor are provided the minimum facilities at the workplace as prescribed under the law. The principal employers are generally found indifferent to the appalling working conditions of contract labour while, in other cases, the exploitation is carried out by the contractor with the active connivance of the principal employer. In the face of the fact that contract workers were being thrown out of employment on a large-scale in the wake of abolition, the Union Government did not initiate any steps to review and do something about this clumsy enactment.

2. The CL Act can be cited as a striking illustration of a *remedy becoming worse than the disease itself*. Neither the conflicting decisions of various High Courts, which have thrown the industrial community into disarray, nor the warning signals flashed by the Apex Court in *Gujarat Electricity Board* case (supra) proved to be of any avail in waking up the 'powers-that-be' from their deep slumber. The Supreme Court observed:

- "... on the abolition of the contract, the workmen are in a worse condition, since they can neither be employed by the contractor nor is there any obligation cast on the principal employer to engage them in his establishment. We find that this is a vital lacuna in the Act. Although the Act is placed on the statute book with all benevolent intentions... the legislature has not provided any relief for the concerned workmen, after the contract is abolished." (at p. 810). (emphasis added).

3. The concept of 'out-sourcing' has become a buzz word in the modern management parlance. The concept, which was originally confined to the 'make-or-buy' decisions in respect of materials, has of late acquired a perverted meaning in management circles to the point of 'out-sourcing' even human resources by employing indirect labour and, thus, pointing to a drift into the dark ages of exploitation and serfdom. The following observation made by the Supreme Court in *Gujarat Electricity Board* case (supra) is an eye-opener to the employers, who have embarked on a programme of de(in)humanising their business operations:

- "... The only ostensible purpose in engaging the contract labour instead of the direct employees is the monetary advantage by reducing expenditure. Apart from the fact that it is an unfair labour practice, it is also an economically shortsighted and unsound policy, both from the point of view of the undertakings concerned and the country as a whole. The *economic growth is not to be measured only in terms of production and profits*. It has to be gauged primarily in terms of employment and earnings of the people. *Man has to the focal point of development...*" (at p. 823) (emphasis added).
4. While delivering judgment in the *Air India* case (supra), the Supreme Court has virtually plugged all conceivable loopholes in the law with a view to prevent any possible mischief on the part of employers. The Court observed:
    - "The award proceedings as suggested in employment *Gujarat Electricity Board* case (supra) are beset with several incongruities and obstacles in the way of the contract labour for immediate absorption. Since, the contract labour gets into the service of the principal employer, the union of the existing employees may not espouse their cause for reference under S. 10 of the I.D. Act. The workmen, on abolition of contract labour system, have no right to seek reference under S. 10 of the I.D. Act. Moreover, the workmen immediately are kept out of job to endlessly keep waiting for award and thereafter resulting in further litigation and delay in enforcement. The management would always keep them at bay for absorption. It would be difficult for them to work out their right. Moreover, it is a tardy and time-consuming process and years would roll by. Without wages, they cannot keep fighting the litigation endlessly. *The right and remedy would be a teasing illusion and would be rendered otiose and practically compelling the workmen at the mercy of the principal employer...*" (at pp. 1149-50) (emphasis added).
  5. The *Air India* decision serves as a point of departure in industrial adjudication and comes as a rude shock to the industrial community, for almost all the undertakings carry on their business with a substantial, if not the whole, component of contract labour. While this is the development with regard to law, the story on the industrial relations front is no different. Given the fact that principal employers have had a field day for a long time abusing the

system to the hilt, it will be an uphill task for them to clear this self-created mess and restore orderly functioning. This second restructuring (or, properly so-called, *the undoing of what has been done during the past few years*) will be an expensive proposition. The problem calls for a thorough understanding of the legal implications and industrial relations aspects apart from consummate skills tempered by vision. This is one of the several branches of personnel function, wherein 'proactive software' finds itself grossly inadequate in providing maintenance support to, or enhancing the problem-solving skills of, the up-coming managers.

6. Notwithstanding the inherent disabilities which the contract workers suffer from, such as, short-tenures of service, employment instability, job insecurity, lack of solidarity, problems of organising and so forth, they are in a vantage position today than ever. It is not uncommon that, in many instances, contract worker' unions submit their charter of demands to the contractor, with a copy to the principal employer. And the principal employer himself normally negotiates with the contract worker' unions directly (of course, unofficially), while the long-term settlement is formally signed by the contractor, in his capacity as the immediate employer.

**Notwithstanding the inherent disabilities which the contract workers suffer from, such as, short-tenures of service, employment instability, job insecurity, lack of solidarity, problems of organising and so forth, they are in a vantage position today than ever.**

7. The *Air India* decision can be considered as a landmark judgment in so far as it cured a long-standing congenital defect in the CL Act by extending the meaning of the term 'abolition' to imply 'automatic absorption', and providing relief to the wronged millions. It is important to note that this decision is not merely confined to a particular class, scale or sector of industries. *Rather, it is the pivotal provision of the Act that has been given a beneficial construction in favour of workers. Private sector employers are as much governed by the decision as their public sector counterparts.* Persistence with contract labour system in operations, where it

has been abolished, or the non-absorption of such workers will be fraught with peril in terms of retrospective regularisation, differential back-wages and attendant benefits.

8. The practice of organising separate unions for contract workers is also undergoing a dramatic change and is fast fading out. Contrary to the tradition, the trade unions of permanent workmen—at the sectoral and unit levels—which were hitherto negatively disposed to contract workers have cleared the decks for contract workers to become members of these unions. Several factors are responsible for this change. Most important among them is the dwindling membership of unions due to large-scale separations of permanent workers. This new trend is having its own spill-over effect on the employer-employee relations. Principal employers can no longer use their favourite argument of sifting issues as between permanent and contract workers. Managements are under severe pressure to absorb contract workers, at least selectively and in phases, if not in a single pull. Some concession to the unions, in this regard, is becoming imperative in order to maintain industrial peace and harmony. This, then, raises the more basic question: "*whither all this downsizing exercise?*"
9. The government should speed up the long-pending reforms in 'labour' sector, in the context of economic liberalisation. The reforms should address issues, such as, trade-union consolidation, 'one-union, one-industry', determination of bargaining agent, linking bonus and a portion of wages to performance/productivity, minimising third-party intervention in dispute settlement, and promoting measures aimed at bilateralism and collective bargaining. Coming to the ID Act, much remains to be done. In the course of its long journey spanning five decades, this enactment has lost its original track, namely, 'regulating' employer-employee relations. Judicial activism coupled with the incorporation of highly restrictive provisions in the Act—particularly, during the black days of emergency—transformed it into an oppressive law, forcing employers to take refuge in innovative, unlawful means.
10. The following issues call for immediate attention and action. The definition of 'retrenchment' (S. 2 [oo]), which has acquired a strange connotation at the hands of judiciary, requires to be amended to mean "discharge of surplus labour." It should manifestly exclude all other

types of termination from its purview. Chapter V-B, which is responsible for many of the malpractices we witness in today's industrial management, should be repealed. Alternatively, S. 25-F, FF and FFF be amended enhancing the compensation payable to workmen in the event of retrenchment, and transfer/closure of undertakings, which will meet the ends of justice for both parties. The amended definition of 'Industry' [S. 2 (i)] should be enforced immediately, as there is no convincing explanation to keep it in a 'moribund' state for such a long period as 15 effect on employment practices of which, the engagement/exploitation of contract workers is but an inseparable part. The earlier the government responds by taking some positive steps in this direction, the better.

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# Corporate Culture: Building Spirit for High Performance

Sunita Singh-Sengupta

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*The present paper is an effort to identify the existing corporate cultures in Indian organisations with respect to productivity. The author has collected cases of six different organisations. The sampled organisations comprised three from the public sector and three from the private sector. The findings revealed that better the fit the better the performance and vice versa. Two things become important at this point: (1) Leadership—efforts to articulate and implement a business vision and strategy, and (2) the competitive and regulatory environment. Three categories of corporate cultures emerge on the basis of present research: (i) strategically appropriate culture, (ii) adaptive culture and (iii) strategically inappropriate culture.*

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## Where Does Corporate Culture Come From?

The taproot of corporate culture is the organisation's belief and philosophy about how its affairs ought to be conducted and the reasons why it does things the way it does. A company's culture is manifested in the values and business principles that the management preaches and practises, in its ethical standards and official policies, in its stakeholder relationships (especially its dealings with employees, unions, stockholders, vendors and the communities in which it operates), in the traditions the organisation maintains, in its supervisory practices, in employees attitudes and behaviour, in the legends people repeat about happenings in the organisation, in the peer pressures that exist, in the organisation's politics, and in the *chemistry* and the *vibrations* that permeate the work environment. All these sociological forces, some of which operate quite subtly, combine to define an organisation's culture (Thompson & Strickland III, 1995).

Beliefs and practises that become embedded in a company's culture can originate: from one influential individual, work group, department or division, from the bottom of the organisational hierarchy or the top. Very often, many components of the culture are associated with founder or other early leaders who articulated them as a company philosophy, a set of principles which the organisation should rigidly adhere to, company policies, a vision, a business strategy, or a combination of these (Fig. 1).

**A company's culture is a product of internal social forces; it represents an interdependent set of values and behavioural norms that prevail across the organisation.**

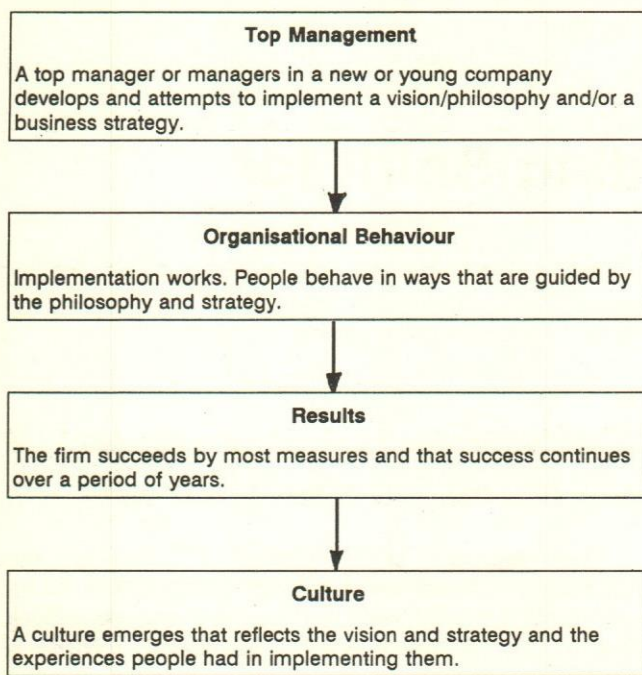


Fig. 1. One Common Pattern in The Emergence of Corporate Cultures

Over time, these cultural underpinnings come to be shared by company managers and employees and then persist as new employees are encouraged to adopt and follow the professed values and practices. A company's culture is a product of internal social forces; it represents an interdependent set of values and behavioural norms that prevail across the organisation.

Culture can be very stable over time, but they are never static (Kotter & Heskett, 1992). Crises sometimes force a group to reevaluate some values or set of practices. New challenges can lead to the creation of new ways of doing things. Turnover of key members, rapid assimilation of new employees, diversification into entirely different businesses and geographical expansion can all weaken or change a culture.

#### *The Power of Culture*

A close culture-strategy match that energizes people throughout the company to do their jobs in a strategy-supportive manner adds significantly to the power and effectiveness of strategy execution. Strong cultures promote good long-term performance when there's better fit and hurt performance when there's little fit.

Kotter and Heskett (1992) conducted four studies between August 1987 and January 1991 to determine whether a relationship exists between corporate culture

and long-term economic performance. The findings suggested:

- Corporate culture can have a significant impact on a firm's long-term economic performance.
- Corporate culture will probably be an even more important factor in determining the success or failure of firm's in the years to come.
- Corporate cultures that inhibit strong long-term financial performance are not rare; they develop easily, even in firms that are full of reasonable and intelligent people.
- Although tough to change, corporate cultures can be made more performance enhancing.

Once established, a company can be perpetuated by continuity of leadership, by screening and selecting new group members according to how well their values and behaviour fit in, by systematic indoctrination of new members in the culture's fundamentals, by the efforts of senior group members to reiterate the core values in daily conversations and pronouncements, by the telling and retelling of company legends, by regular ceremonies honoring members who display cultural ideals and by visibly rewarding those who follow cultural norms and penalizing those who do not. However, crises and new challenges evolve into new ways of doing things. Arrival of new leaders and turnover of key members often spawn new or different values and practices that alter the culture. Diversification into new business, expansion into different geographical areas, and rapid growth that adds new employees can all cause a culture to evolve.

Although it is common to speak about corporate culture in the singular, companies typically have multiple cultures (or subcultures). Values, beliefs, and practices can vary significantly by department, geographic location, division, or business unit. A company's subculture can clash, or at least not mesh well, if recently acquired business units have not yet been assimilated or if different organisational units have conflicting managerial styles, business philosophies, and operation approaches.

#### *Strong Versus Weak Cultures*

Company cultures vary widely in the degree to which they are embedded in company practices and behavioural norms. A company's culture can be weak and fragmented in the sense that subcultures may exist, few values and behavioural norms are widely shared, and there are few traditions. In such cases, organisational members typically have no deeply felt sense of

company identity; they view their company as merely a place to work and their job only as a way to make a living. While they may have some feeling of loyalty toward their department, their colleagues, their unions or their boss, they usually have no strong emotional allegiance to the company or its business mission. On the other hand, a company's culture can be strong and cohesive in the sense that the company conducts its business according to a clear and explicit set of principles and values, that management devotes considerable time to communicating these principles and values to organisational members and explaining how they relate to its business environment, and that the values are shared widely across the company—by senior executives and rank-and-file employees alike. Strong culture companies typically have creeds or values statements, and executives regularly stress the importance of using these values and principles as the basis for decisions taken and actions throughout the organisation. In strong culture companies, values and behavioural norms are so deeply rooted that they do not change much even when a new CEO takes over—although they can erode over time if the CEO ceases to nurture them.

**In strong culture companies, values and behavioural norms are so deeply rooted that they do not change much even when a new CEO takes over, although they can erode over time if the CEO ceases to nurture them.**

### The Indian Scenario

Indian organisations are characterised by soft work culture (Singh-Sengupta, 1989, 1990, 1995a; Sinha, 1990), where workers enjoy surplus power and the managers experience a sense of powerlessness. Such aberrations in normative power distribution is more noticed in public sectors as compared to the private owned (Singh-Sengupta, 1991). The *Chalta Hai Culture* still has its existence. However, the picture in private organisation is not as gloomy. Managers use their authority to a considerable degree. This does not mean that unionism is weak in private organisations. It is very much there but since working in private firms does not give job security, a compliance behaviour is reported.

The culture of any organisation is determined by the social milieu in which it is functioning, the history of the organisation, the values and beliefs system of the employees, the state policy and the informal groups from where one extracts power. Amongst these, the state policy seems to be the deciding factor as it influences

the output of any organisation directly. As the policy of the government changes, accordingly changes the thrust of the companies. Globalization has assumed importance in almost every sphere of Indian economy. The transition from a controlled economy to an open economy, brings with it the challenges of change that have a significant management connotation. To compete in the international market the Indian organisations have to transform its work culture into a synergetic one (Singh-Sengupta, 1995b). The behaviour of the employees has to be according to the requirements of the organisation (Table 1).

**Table 1:** Employees' Behaviour in the New Work Environment

Organisational requirement	Employees' behaviour
1. Work related	
a. Time spent at work	More than statutory requirement
b. Extent of employees' hard work behaviour	To a great extent
c. Role clarity	High
d. Job affect	High
e. Centrality of work	High
f. Job satisfaction	High
2. Social-personal obligations	Low
3. Organisational Climate	
a. Physical conditions of work	Reasonably good to excellent
b. Superior-subordinate relationship	Positive
c. Work pressure	High
d. Work norms	Strong
e. Upkeep of technology	Good
f. Reinforcement	Contingent on hard work
4. Loss bearing capacity	Low
5. Self-reliance	High
6. Chief concerns	Productivity leading to welfare and cooperative industrial relations.
7. Management systems	Effective
8. Managerial styles	Assertive and humane

Source: Singh-Sengupta, 1995b.

Against this backdrop the present piece of research was designed to examine the extent to which the Indian organisations have shifted their focus from complacency to competition, from internal orientation to an international approach, from soft work ethics to total work commitment and from traditional management practices to pioneering-innovative management practice.

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## Method

### *The Study*

The present study is an attempt to examine the existing corporate cultures in Indian organisations in order to trace a relationship between the demands of the business environment and the corporate strategies. It attempts to explore whether there is a proper match between the two. The thrust of the paper is to identify the issues which lead to strong and supportive corporate cultures.

### *The Sample*

Three public sectors and three private sectors constitute the sample for the present study. The rationale behind including public as well as private sectors in our sample was to investigate the levels of adaptability to the changed economic scenario as a function of public or private nature of ownership.

### *Cases*

The investigator collected cases from the CEOs of six different organisations. The obtained cases can be put under three broad headings:

Organisations having:

- \* Strategically appropriate culture.
- \* Adaptive culture.
- \* Strategically inappropriate culture.

### **Strategically Appropriate Culture**

#### *Cummins Diesel Sales and Service*

Cummins Diesel Sales And Service (I) Ltd. (CDSS) is a wholly owned subsidiary of Kirloskar Cummins Limited. KCL was formed in 1962 with 50 per cent collaboration with Cummins Engine Company of Columbus, USA. Kirloskar had 24.5 per cent share then and the rest was held by public. Today CECC, USA has 51 per cent share and Kirloskar house has 23.5 per cent share. KCL manufactures diesel engines from 70 to 2000 horse power at 2100 rpm. Their products are used in gensets, compressors, earth moving equipments, railway engines etc. CDSS looks after the post market support of KCL and Cummins Engines in India, Bhutan and Nepal. CDSS had a turnover of Rs. 220 crores last year. It has 98 dealers, 5 Zonal offices, 6 regional offices and 14 Area service offices throughout India.

The corporate culture in this organisation has changed drastically over the last 15 years because of change in customers and competition. The company has consciously changed its approach towards customer, quality concept and employee care. To make it all happen, the top management played a crucial role by (a) getting involved personally with the employees working at the lower rungs of the hierarchy and (b) frequently monitoring the system laid down. As a result absenteeism reduced and labour turnover was almost nil. The company was reported to possess highly valued customers, employees, and stockholders. There seemed to be a shared belief that the firm should select people with leadership potential, develop that potential and then encourage people to lead. Hence, there seemed to be a fit between the company's corporate culture and the environmental demands, i.e., market, technology etc.

#### *Blowplast Ltd.*

Incorporated as a Pvt. Ltd. Company in 1965, the main business of Blowplast Ltd. was manufacturing and marketing of industrial and custom moulded plastic items and carboys. In 1968 the company started manufacturing PVC footwear. It diversified into the area of moulded luggage in 1971. The Company was taken over by the Piramals in 1973-74. It divested itself of the footwear business in 1976. It then started soft luggage operations in 1983. Launched Foods and Writing Instruments Divisions in 1985-86. Both operations were closed in 1987-88. Consolidated main business line and completed 25 years of operations in 1991. Main business lines at present: Moulded Luggage (ALFA, VIP, ODYSSEY) Soft Luggage (SKYBAGS), Furniture (MODERNA, KLOBER, ELEMENT) and Toys (LEO, LEO-MATTEL).

In 1987-88 there was a sea change in the company because it was going through a transition period. The company was not gaining much as a result of which it had to change its styles. It was further reported to be aggravated by the liberalization policies of the government. Many professionals were inducted into the company. These managers were given full autonomy. Those employees who could not cope with the changed situation left the organisation. Thus, with a fresh workforce, the new ethos were enforced. The individual branch managers were called for a conference and the proposed changes were announced and the managers were asked to implement them. These changes were initially opposed but as the company had its brand image, over a period of time, it got the cooperation of the people in the market.

The company was reported to have *Chalta Hai Culture* initially however, it has now shifted to a complete

professional culture which values transparency and fair deal. The previous culture hurted the economic performance of the company. However, reported changes were found to enhance profitability. The present corporate culture values customers, employees stockholders, and excellent leadership. There seems to be a match between the company's culture and competitive, technological and other environments in which the firm is functioning.

### **Adaptive cultures**

#### *Hindustan Copper Ltd. (HCL)*

Hindustan Copper Ltd. (HCL) was incorporated on 9th November, 1967. It is a Public Sector Enterprise under the Ministry of Mines, Govt. of India. HCL is the sole producer of primary copper in the country, It has been entrusted with the responsibility of fulfilling the long term objective of development and growth of copper industry on sound lines by exploiting copper ore deposits, located in various parts of the country and by adopting appropriate and modern technology to maximise the indigenous production of copper. The company is operating the following projects: (1) Khetri Copper Complex, Rajasthan. (2) Indian Copper Complex, Bihar. (3) Malanijkhand Copper Project, Madhya Pradesh. (4) Taloja Copper Project, Maharashtra (Continuous Cast Copper Wire Rod Plant).

Participative style with transparency as a corporate value seemed to prevail in HCL which resulted in good industrial relations among the employees. Because HCL runs projects in rural areas, there is no impact to turnover and absenteeism rate is high. Earlier whole thrust was on social welfare. Over the years, the profitability of this public sector has not been satisfactory. Therefore to enhance profitability, manpower reduction was emphasized. HCL adopted it as it was announced in the new economic policy that all the public sectors have to be self-reliant, which led to high level of production.

Some necessary changes were brought about. For example, overtime was completely stopped. The changes were implemented with the help of the workers who accepted it and the top management who encouraged the middle and lower management to be participative and more transparent in their approach. The corporate culture helped in enhancing profitability. Career resilient programmes were introduced and implemented so that all the employees become multi-skilled. Environment-culture match was also found to be good.

#### *Glaxo Ltd.*

Glaxo Ltd. started its operations in India as a milk powder producing company. Later in the 1950s it started manufacturing pharmaceutical drugs also. In 1992 Glaxo disbanded its family product division and started concentrating on pharmaceutical drugs only.

The culture of the company seems to have changed over the years. Major changes were brought in the speed of operations. Employee care has recently caught the focus. Growing competitions in the drug industries has led to such changes. Tight time schedules are fixed and reviewed periodically to make this change happen, which was not very easy because people had to change the ways they had been operating hitherto. This trend first started about two years back. The leadership at the top played an effective role. Though the corporate culture had contributed to enhanced performance of the company, it did not seem to have much impact on the rate of absenteeism. However, labour turnover was reported to have reduced.

The company was found to value customers, stockholders, and leadership highly but it valued the employees partially. As a result of these changes and its shifting focus, the company matched well with the external demands.

### **Strategically Inappropriate Culture**

#### *Minerals and Metals Trading Corporation (MMTC)*

In October 1963, MMTC was carved out of State Trading Corporation mainly to deal with minerals and metals. Its function was to export all mineral items and import the non-ferrous metals. In this area MMTC had its monopoly but after liberalization, dechannelization of this non-ferrous item took place and MMTC lost its monopoly and it had to compete with others.

The change occurred at the corporate level to bring new culture in MMTC. The new culture focused on participative styles of management with a positive attitude towards new and innovative changes brought into the organisation. However, the company still has the bureaucratic way of functioning. For survival, such changes were necessary and it took considerable amount of time and energy to make it happen. Unfortunately the attitude of people has not changed much as they still believe that they cannot be taken to task because of their job security. In this process the role of top management becomes crucial. The leadership at the top helped in enhancing performance and minimizing the rate of absenteeism. The present corporate culture

values customers, employees, and stockholders highly, however, it seemed to fail to value the excellent leadership from its managers. As a result the culture of the company does not fit well with the external demand of the business environment.

#### *IBP-Balmer Lawrie Group of companies*

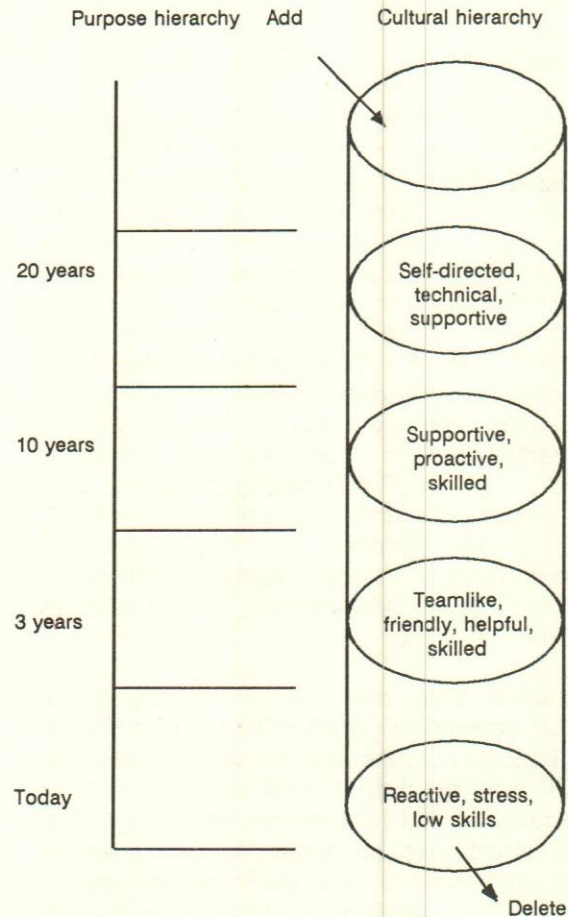
The company was formed in 1908 by Jamal Brothers. Later the company was taken up Indian Oil Corporation and after a few years it became an independent company. It markets petroleum products and manufactures industrial explosives and industrial cryocans. With the new liberalized economic policy the competition increased in the oil sector and in order to remain viable, the company has introduced certain changes. The thrust is now on dramatic growth to enhance productivity. The message that is being conveyed is, "pull-up your socks, perform well or you will be out". The corporate policies are being formed rigorously but not transferred in reality down the line. To implement it, a total transformation of work culture is required which has not yet been done. At the same time the people feel that there is absence of direction and effective leadership at the top in this company. At the middle and lower level there seems to be minimum level of organisational commitment. The owners were benefitted and thus in the absence of a fair performance-incentive system the employees felt de-motivated. This culture over the years has not been found not to match well with the demand of environment. The company partially values customers, employees, and stockholders. However, evidences suggest that leadership qualities and potentials were not valued in the company which contributed to the strategically inappropriate culture in the company.

#### **Discussion**

Liberalization of economy has affected the business environment which seems to have its impact on human resources environment and subsequently on the work environment. There seems to be paradigm shifts. Today workforce have been given the major thrust. Of late it has been realized that it is the workers who make the organisations run. The cases collected for this paper strongly value a motivated and committed workforce (Singh-Sengupta, 1994).

The role of top leader becomes very crucial in this changed situation. He has to manage the organisation strategically by establishing a fit between new strategic thinking and change management. Organisations must learn to make purpose shifts with the appropriate cultural shifts simultaneously. The purpose and cultural hierarchy shifts are outlined in Fig. 2. Both the purpose

shift and the cultural shift require an investment. The investment in the purpose shift is largely in terms of capital. The investment in the cultural shift is mainly in human terms: supporting, training, understanding, listening, involving, communicating and guiding the employees to the new purpose. Unfortunately, the cultural investment is usually poorly made and does not reap the dividends it should (Burton & Moran, 1995).



**Fig. 2.** Purpose and Cultural Hierarchy Shifts

#### **Building A Strategy Supportive Corporate Culture**

Every company has a unique organisational culture. Each has its own business philosophy and principles, its own ways of approaching problems and making decisions, its own embedded patterns of *how we do things around here*, its own lore (stories told over and over to illustrate company's values and what they mean to employees), its own taboos and political don'ts—in other words, its own ingrained belief, behaviour and thought patterns, business practices, and personality.

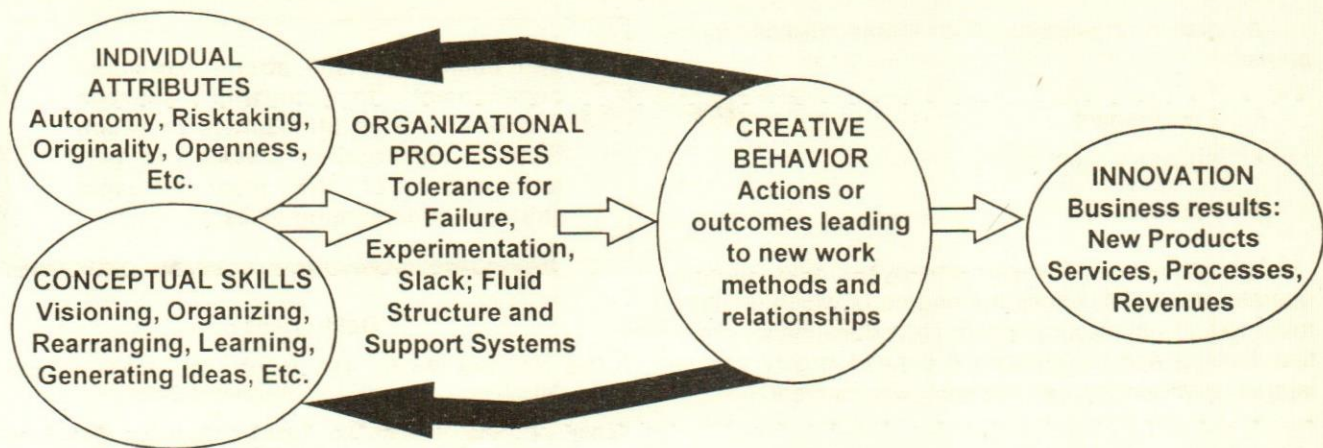


Fig. 3. Influences on Creative Behaviour in Organisations

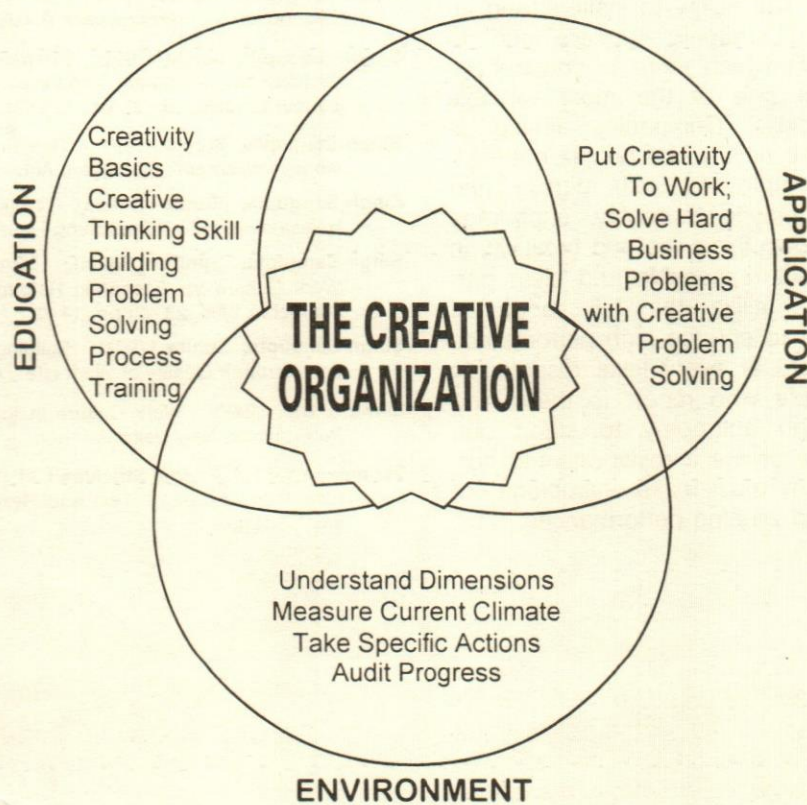


Fig. 4. Three Arenas of the Creative Organization

To respond effectively to turbulent external forces, companies need employees' competencies and behaviours (that are becoming essential to the organisational competitiveness and effectiveness) centre on tradition and look at things at different way. This not only enables to survive but enriches the feeling of high quality of work life (Fig. 3).

#### **Cultural Mechanism for Enhancing Organisational Creativity**

For employees of an organisation or work team to be creative, they must share and exhibit a set of creativity-enhancing values, norms and behaviours, and this must be the mainstay of the corporate culture (Singh-Sengupta, 1997).

A creative organisation (Fig. 4) has basically three arenas:

- \* Environment
- \* Education and
- \* Application

The context in which employees and groups operate greatly influences the degree of which creative thinking and behaviour flourish. The education for creative thinking and its application depend largely on the internal environment, i.e., the work environment.

### Implications of the Study

The case studies of Indian organisations throw some light on *how to build a spirit of high performance* into the culture. The ability to instill strong individual commitment to strategic success and to create an atmosphere in which there is constructive pressure to perform is one of the most valuable strategy-implementing skills. Companies aiming at spirit of high performance have to be people oriented. They have to treat employees with dignity and respect, train each employee thoroughly, encourage employees to use their own initiative and creativity in performing their work, set reasonable and clear performance expectations, utilize the full range of rewards and punishment to enforce high performance standards, hold managers at every level responsible for developing the people who report to them, and grant employees enough autonomy to stand out, excel, and contribute. To create a result-oriented corporate culture, a company must make champions out of the people who turn in winning performances.

**The ability to instill strong individual commitment to strategic success and to create an atmosphere in which there is constructive pressure to perform is one of the most valuable strategy-implementing skills.**

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# Cost of Quality – A Gateway to TQM?

S. Gurusamy

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*In today's globalization, quality of products is the watchword of customer preferences. In the present paper, the costs of maintaining quality termed CoQ, by business enterprise in relation to TQM is discussed. After detailing on the concept of cost of quality, the paper goes on to explore the process and purpose of collecting, analysing and presenting quality cost information. The paper finally touches upon the relevance of cost of quality concept to the Indian industry.*

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## Introduction

In today's market, customers are becoming increasingly more vigorous and their expectations of the product/service in terms of its conformance, reliability, durability, interchangeability, performance, features, appearance, serviceability, environment and user-friendliness and safety are increasing. Under these conditions, the role of quality management is essential. Several tools and techniques are available for the efficient Total Quality Management (TQM). The selection and use of an effective tool is an imperative for supporting and developing the process of continuous quality improvement of an organisation. In this regard, Cost of Quality (CoQ) is considered by the management as one of the important techniques of TQM especially when an organisation changes its approach from detection to prevention as a part of its exercise towards inspection and quality control.

TQM is increasingly being resorted all over the world to justify the cost effectiveness of the investment in the process of continuous quality improvement. This has necessitated the organisations to actively engage themselves in the collection and reporting of quality costs.

Quality today is regarded by most producers and customers as more important than ever in their manufacturing operations, service and purchasing strategies. In the modern world, organisations appreciate the strategic significance of quality in business and corporate health. They have come to believe that quality management will enable them to become and remain competitive in both home and global markets.

**In the modern world, organisations have to come to appreciate the strategic significance of quality in business and corporate health.**

Such a quality management leads to improved productivity, higher standards, improved systems and procedures, improved motivation, increased customer satisfaction and above all, lower grade and bottom line savings.

By using quality as a strategic weapon, Japanese companies have changed the face of contemporary competition. With help from quality gurus like *Deming*, *Juran* and *Taguchi*, many Japanese companies have assumed the number one position in several industries. The focus on quality is not just another passing fad. Instead, it is considered that a business without quality products or services will not survive in the global marketplace. Studies by Ernest and Young and by the Office of Automotive Transportation (University of Michigan) found that quality is the most important critical success factor for the future.

**The focus on quality is not just another passing fad. Instead, it is considered that a business without quality products or services will not survive in the global marketplace.**

### Quality Costs

In recent times the concept of quality costs has undergone rapid changes, causing corresponding changes in TQM. According to the British Standards Institution (BSI), "a quality cost is the expenditure incurred by the producer, by the user and by the community associated with product or service quality". Quality-Related Costs has been defined as the expenditure incurred in defect prevention and appraisal activities plus the losses due to internal and external feature.

**Quality cost is the expenditure incurred by the producer, by the user and by the community associated with product or service quality.**

In this context, a technique, Quality Costing has been evolved wherein companies are facilitated to improving quality and identifying and eliminating excessive costs, waste and non-value adding activity.

The various types of quality costs (depicted in Fig. 1) are described below:

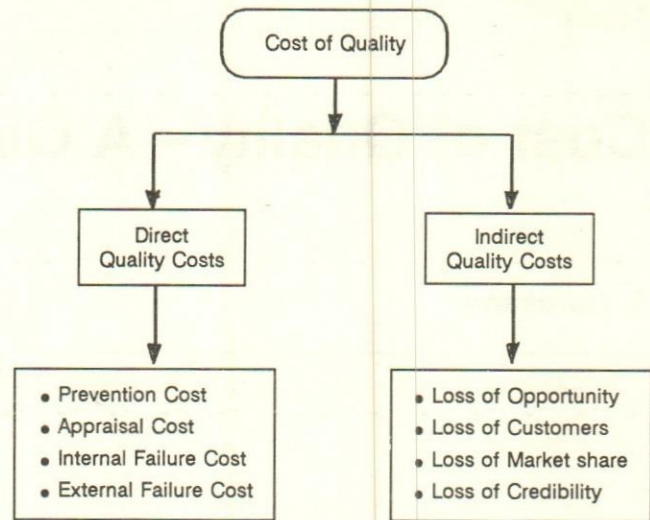


Fig. 1. Quality Costs Types

### Direct Costs of Quality

Costs that are associated with prevention, appraisal and failure of product/service to maintain and improve its quality are grouped under direct cost of quality.

### Cost of Conformance

These are maintenance costs. The cost of conformance is the total of the costs associated with making certain that products or services meet the customer's negotiated requirements and expectations. These costs of conformance will be found throughout the manufacturing process. They exist within each internal customer/supplier relationship. The various costs of ensuring the conformance of product quality are:

*Prevention costs:* which include those arising from every department and activity and are concerned with the prevention of poor quality and elimination of poor work with an objective of enhancing the levels of quality. Prevention costs can take such forms as the *People-associated costs* like job description, personnel selection, training etc.; *Process-associated* like machine maintenance, assuring good supplier quality, environmental improvements etc.; and *Product development-associated costs* like design improvements, market research prior to manufacturing etc.

*Appraisal costs:* which include those costs that are concerned with evaluation of product quality. Appraisal costs can be grouped into such forms as costs associated with *product development* like testing, prototype manufacture, market research follow-up etc.;

those associated with *process failure* like inspection and those associated with *product failure* such as testing final inspection etc.

**Cost of conformance is the total of the costs associated with making certain that products or services meet the customer's negotiated requirements and expectations.**

### **Cost of Non-conformance**

These are the costs associated with failure to meet the negotiated requirements and expectations of the customer. These costs will be the occurrence and accumulation of all the costs owing to failure to keep up the standards. They are found throughout the manufacturing process. The costs of non-conformance include the following:

*Internal failure cost:* Occurs whenever products do not meet requirements and expectations of the customer, but are discovered prior to shipping to the customer. Examples include Scrap, Re-work, Re-inspection, etc.

*External failure cost:* This occurs owing to factors beyond the control of management. These include those costs that are incurred by the company following the shipment of the product or the completion of the services supplied by the company. They imply the existence of non-direct quality costs as well. Examples include warranty expenses, insurance against warranty claims, excessive installation costs, product replacement, complaints procedures, bad debts etc.

### **Indirect Costs of Quality**

There are the costs which occur owing to the ill-effects of direct quality costs. Some of the indirect costs of quality are explained below:

#### **Loss of Opportunity**

These costs result from a failure on the part of a company to take full advantage of an existing opportunity to do business and/or to generate wealth. This may be due to lack of ability within the company to take full advantage of opportunities as they present themselves or from a lack of information or understanding of the marketplace. It may also be due to the fact that the company's energies are pre-occupied with maintaining the present

range of business leading to failure to respond to the changes taking place in the outside world.

#### **Loss of goodwill**

These costs originate usually from the customer, causing him some loss. They are initially incurred by the customer. They comprise negative opinions formed by customer about the company, its products and its services, leading to a loss in reputation and subsequent loss of sales.

#### **Loss of Market Share**

Obtaining market share is the key to long term business success. Loss of market share usually results in higher unit production costs, lower profitability and a greater risk of further decline in business levels.

#### **Loss of credibility**

This is the consequential loss as felt by a customer which directly results from the failure of the product. This also involves loss of another company's reputation. The insurance against such loss by companies should be considered as indirect quality costs. Where claims are pursued, the costs of actually fighting or settling such a claim, together, result in a potentially large cost of quality.

### **Measurement of Cost of Quality (CoQ)**

Quality costs measurement focusses on areas of high expenditure and wastage and identifies potential problem areas and cost reduction and improvement opportunities. Measure of quality cost can be used as a business parameter along with marketing, R&D etc. Drawing quality costs into business area helps to emphasize the importance of quality to corporate health. This would in turn pattern on the behaviour and attitudes of employees of all levels in the organisation towards TQM.

Quality Costing allows measurement of performance and provides a basis for internal comparison between products, services, processes and departments. Measurement of quality related costs also reveals

**Quality Costing allows measurement of performance and provides a basis for internal comparison between products, services, processes and departments.**

queries and anomalies in cost allocation, standards and procedures for disposal of products which may remain undetected by the more commonly used production/operation and labour based analyses.

### **Benefits of CoQ**

The basic purpose of quality costing is to improve performance so as to satisfy customer needs and expectations. It measures the internal quality performance. It is a first step to TQM journey. A knowledge of quality costs helps managers to justify the investment in quality improvement, to assist them in monitoring the effectiveness of the efforts made and to assess the impact of various improvement activities. Quality costs are important because they constitute a sizeable amount. For instance, it constituted 10 per cent of the U.K.'s GNP in the year 1978. According to the National Economic Development Council, around 10 to 20 per cent of an organisation's total sales valued is accounted for by the quality-related costs. Similarly, over 95 per cent of the quality costs is usually expended on appraisal and failure. These expenditures add little to the value of the product or service. Likewise, unnecessary and avoidable costs make goods and services more expensive which in turn affects competitiveness and ultimately wages, salaries and standards of living.

### **Parameter of Corporate Health**

Quality costs data help in improving the corporate health. Knowledge of quality-related costs enables business decisions about quality to be made in an objective manner. It permits the use of Sensitivity Analysis, Discounted Cash Flow and other accounting methods and techniques for the evaluation of projects as in any other area of the business. A large part of company's decision is based on scrap, rectification and rework costs and fault-finding.

**Quality costs data help in improving the corporate health. Knowledge of quality-related costs enables business decisions about quality to be made in an objective manner.**

### **Performance Measurement**

Quality Costs are used for decision making purposes by identifying products, processes and departments for investigation by allocating resources, to set cost reduction targets and by measuring progress

towards costs. It focuses its attention on the chronic problems for which compensation has been built into the system. It can also be used for rating the vendors. According to Winchell, 1987 there are visible and invisible quality costs that are used for the purpose of vendor rating and these include the following:

- Receiving or incoming inspection
- Measuring equipment calibration
- Qualification of supplier product
- Source inspection and control programme
- Material review
- Purchased material replacement
- Rework of supplier-caused rejects
- Scrap of supplier-caused rejects
- Costs that are incurred by the supplier at his plant
- Cost incurred by the buyer in solving problem at the suppliers plant etc.

### **Planning & Control**

Quality costs are the basis for budgeting and eventual cost control. In fact, the prime purpose of quality costing system is presenting management with a means of planning and controlling the costs of various types.

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### **Motivational Device**

Quality costs may also be used for causing the improvements at all levels in a company. Costs have traditionally been used to motivate senior managers to become interested and take part in the promotion of quality costs and to enable them to find out whether there is a major opportunity for waste and cost-reduction. As companies move towards TQM, the use of costs as a motivator, becomes more widespread. Uses of motivational purposes include display to shop floor workers of scrap costs arising within their departments and to emphasize to middle managers, their department's contribution to total quality costs.

## CoQ Reporting

It is essential that Quality Costs reporting is done in order to collect and display the costs that are associated with the maintenance of quality of production and service. There is a popular notion among the quality management practitioners that the quality costing reports indicate the origin of failure costs by department i.e. design, production, engineering, purchasing, marketing etc. This is to be done with the fond hope of provoking remedial action by the respective departments.

The influence of senior management is vital in the reporting of quality costs. If there is no pressure to reduce costs against mutually agreed targets, then reporting will become routine. It is important that senior management develops a quality costs reduction strategy.

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## CoQ Measurements

Several approaches are used for measuring the Quality Costs. Most popular among them are: (i) Juran's Model and (ii) Taguchi Model.

According to the *Juran's Model*, all products/parts considered good are assigned equal value for quality, even though one product/part may not match the quality expectations while another may match the target value exactly.

According to the *Taguchi's Approach*, a company gains virtually nothing by shipping a product that barely meets the quality costs specifications over a product that just fails. He exhorts manufacturer to meet targets rather than trying to stay just within specifications. This is based on the argument that a product which barely meets specifications is likely to fail in the hands of the customer. This would result in loss of customers.

## CoQ & TQM-Interface

Cost of Quality (CoQ) is one of the several quality management tools and techniques which an organisa-

tion can use in the introduction and development and development of a sound practice of TQM. When organisations start changing their approach from detection to prevention, quality costing is considered an important necessity by the senior management team. This awareness of quality costs begins to surface especially when management becomes aware that its current approach to quality management is deficient.

An efficient and effective Quality Costing undoubtedly paves the way for a sound TQM and for an excellent corporate health. Quality costing, therefore, ensures a smooth journey towards TQM. Organisations worldwide employ quality costing measures as an indication of internal quality performance. Figure 2 reveals the step-by-step approach to TQM through the mechanism of Quality Costing.

**An efficient and effective Quality Costing undoubtedly paves the way for a sound TQM and for an excellent corporate health.**

A knowledge of quality costs help managers justify the investment in quality improvement, assists them in monitoring the effectiveness of the efforts made and to assess the impact of various improvement activities. It is used to reduce the number of errors and mistakes along with the associated costs. This way it will free-up employees' time and help to use them in a more effective way. Quality costing expresses an organisation's quality performance in the language of the board, the senior management team, shareholders and financial institutions. It is often found that boards and senior management teams are unmoved by quality assurance data but are spurred into action when the same data are expressed and presented in monetary terms.

## CoQ: Relevance for India

With the liberalization, privatization and globalization of the Indian Economy, industries in India face a virtual invasion by MNCs. This has, infact, added a new dimension to the style of functioning and management of industries in India. The Indian industries have fully realized the need for improving the quality of their products/operations with a view to put up a strong competition to foreign products to survive in the domestic market not to speak of their dire necessity to promote their products in the global market.

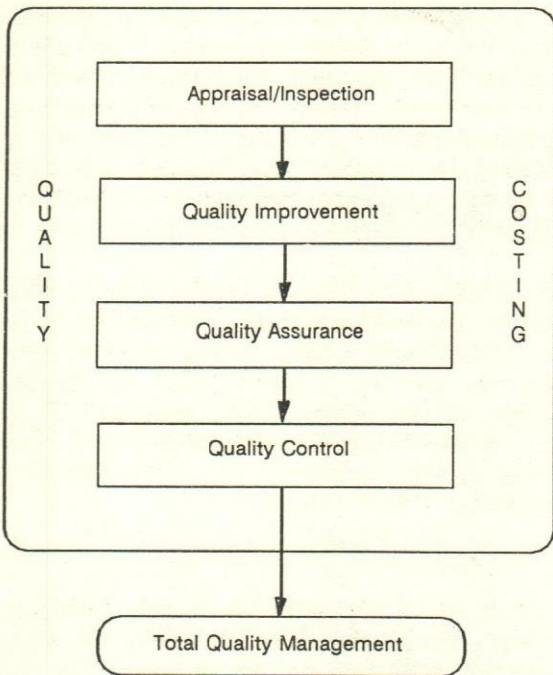


Fig. 2. CoQ & TQM—Interface

Industries spend considerable amount of money towards activities required for maintaining and improving the quality of products or service. This is done through inspection, quality control and quality assurance. It gratifying to see that this quality costing exercise has gradually started facilitating the use of quality manage-

ment tools and techniques ultimately accomplishing the Total Quality Management (TQM) in all spheres of industrial operations in India. This is evident from the fact that a large number of Indian companies have obtained *ISO certification* for their products and services.

### Conclusions

A quality-conscious manufacturer aims ultimately for achieving Total Quality Management (TQM) in all operations. Quality has become the watch-word which is destined to give a company an edge over its competitive rivals both in domestic and global markets. Quality Costing as a technique of TQM ensures making and selling of quality products and services.

With a large number of companies in India going global in their trade activities, there is an inevitable need for upgrading and improving the quality of production. In this connection, it is gratifying to note that such companies vie with each other to obtain the *International Certification* of quality for their products. This, it is hoped, would greatly contribute to the practice of TQM in their respective organisations on a wider scale. In conclusion, it may be stated that expending money for maintaining and improving the quality leads definitely to the path of and the ultimately to the goal of TQM.

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# Returns to Higher Education: Estimating Using A Flexible Functional Form

K.R. Shanmugam and S. Madheswaran

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*In order to estimate the returns to education, Mincerian earnings equation is widely used. However, there is a debate on the specification of this model concerning the functional form of the dependent variable—whether logarithmic or absolute earnings. This study estimates the returns to schooling in South India using a large sample to address the problem of selecting the correct form of the dependent variable. The flexible functional form estimator and the likelihood ratio test were applied and it was found that the semi-logarithmic earnings equation is the appropriate one. Since the marginal rates of returns to higher education are lower, the study suggests that the government subsidies may be reduced.*

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## Introduction

According to Ruskin, "Education consists making people polite, what they ought to be". People invest in education. These investments involve an initial cost and they are made in the hope and expectation that they will pay-off well into the future. The governments also invest in education to raise the skill level and productivity of labour and thereby enhance income of the society.

In India, the expansion of the education sector since Independence is quite impressive. During 1950-51 to 1995-96, the number of primary schools rose from 2.1 lakh to 5.9 lakh and that of upper primary schools went up from 0.14 lakh to 1.71 lakh. Between 1950-51 and 1982-83, the student population increased from 2.8 crores to 11.4 crores, yielding a growth rate of 4.5 per cent per annum (Government of India, 1985). In 1994-95, the enrollment of children in the age of 6-14 alone in our schools was 151 million, covering about 91 per cent of the children in this age group (Government of India, 1997). The literacy rate of the country has also registered an increasing trend. It was 18.3 per cent in 1951 and rose to 52.2 per cent in 1991. The country spends a little more than 3 per cent of its GNP on education. In fact, education is the second highest sector of budgeted expenditure after the defence sector. In the third plan (1961-66), the outlay on education was Rs. 588.7 crores, while in the eighth plan (1992-97) it reached a peak of Rs. 19599.7 crores.

Since the resources are scarce, it is necessary to assess whether the investments in education are worthwhile. Literature suggests that the investments are viable if the present value of benefits is atleast as large as the costs. Alternatively, one can adopt the internal rate of return ( $r$ ) criteria. If  $r$  exceeds the alternative rate of return, the investment is considered profitable. The question then is how to estimate  $r$ ? T.W. Schultz, the Nobel Prize Winner, argues that at the individual level, the positive relationship between the education of a

worker and his or her earnings help to account for the noted expansion of national educational systems. Under certain conditions, the proportionate increase in average life time wages associated with a year's education approximates an internal private rate of return to investing a year time in that form of schooling.

**Under certain conditions, the proportionate increase in average life time wages associated with a year's education approximates an internal private rate of return to investing a year time in that form of schooling.**

After the pioneering work of Mincer (1974), several studies emerged to estimate the rates of return to education in both developed and developing nations using the eponymous Mincerian earnings equation (Psacharopoulos, 1985). A key assumption underlying the estimation of rates of return to education based on the Mincerian equation is that it accurately represents the opportunity set faced by the typical individual. However, if the full opportunity set is unobserved and if the labour market is not fully competitive, the opportunities vary among individuals, and hence, various factors could cause different returns in wage employment above those earned elsewhere.

The existing studies show that investments in basic primary and secondary schooling yield private returns between 10 per cent and 40 per cent in the developing nations and generally the returns are somewhat lower at university or college levels. In few countries, the students pay the full cost of education. Social returns to schooling after deducting the unreimbursed public expenditure on education are therefore lower than the private rates of return. However, there are a variety of sources of bias associated with these estimates. They include the ability bias, the measurement error, the endogeneity and other types of selectivity bias issues. Besides, Mincer's model relies on the strong assumption that the appropriate definition of the dependent variable is the natural logarithm of earnings, not the earnings as such. However, there is a debate on the specification of the model concerning the functional form of the equation. Heckman and Polachek (1974) applied a general transformation, known as Box-Cox transformation to test the functional form of the wage equation using U.S. data. They concluded that the national logarithm of earnings (i.e., the semi-logarithmic form of the earnings equation) is appropriate. Literature survey shows that no such attempt has been made in the Indian context. In this study, our main objective is to calculate the rate of

return to education in South India and to check the empirical validity of using the Mincerian earnings function in estimating the returns to education. Due to data limitations, we do not consider the other issues. The data also restrict our analysis to estimate only the returns for higher studies in India.

## Data & Modelling

The data were taken from the Degree Holders and Technical Personnel (DHTP) survey, conducted along with Census of India, 1981. For the analysis, we used a sub-sample of male scientific and technical personnels belonging to southern region of India. We excluded the unemployed persons (for whom no wages are observed) and those sample with missing information. The restricted sample consists of 28567 male respondents from Tamilnadu, Andhra Pradesh, Kerala and Karnataka states.

The empirical model consists of estimating the earning equation of Mincerian Form:

$$\ln Y_i = \alpha + \beta S_i + \gamma_1 T_i + \gamma_2 T_i^2 + U_i \quad (1)$$

Where  $Y_i$  is the monthly earned or labour income of the individual  $i$ ;  $S$  represents the schooling attainment;  $T$  is the years of experience in the job<sup>1</sup>;  $\alpha$ ,  $\beta$ ,  $\gamma_1$  and  $\gamma_2$  are the parameters to be estimated; and  $U_i$  is the random error term. The coefficient of  $S$  (i.e.  $\beta$ ) can be interpreted as private rate of return to investing an additional year in education. Since marginal returns may vary by level of education  $q$ , the above equation can be written in the following form (Psacharopoulos, 1981):

$$\ln Y_i = \alpha + \sum_q \beta_q D_{iq} + \gamma_1 T_i + \gamma_2 T_i^2 + U_i \quad (2)$$

Where  $D_i$ s represent the dummy variables for different levels of education. In this specification, the coefficients on the educational dummies do not directly provide the rate of return. We can convert them into rates of return using the formula  $\beta^* = (e^\beta - 1)100$  (Palmquist and Halvorsen, 1981). Then the marginal rate of return to investing one year at the  $q$ th level of education ( $R_q$ ) can be calculated. It is done by taking the difference between the estimated rates of return for  $q$  and  $q-1$  level of education and dividing it by the number of years of schooling at the  $q$ th level ( $n_q$ ):

$$R_q = [\beta^*_q - \beta^*_{q-1}] n_q \quad (3)$$

1. The term  $T^2$  is included to allow for the standard non-linearity in earnings profile over the working life of the individual.



The mean and standard deviation of the variables used in the empirical analysis are given in Table 1 (column 1).

### Estimation & Results

One of our objectives is to select the ideal functional form of the dependent variable. We apply a flexible functional form estimator. The Box-Cox transformation of (2) takes the following form:

$$\frac{Y^{\lambda}-1}{\lambda} = \alpha + \sum_q \beta_q D_{iq} + \gamma_1 T_i + \gamma_2 T_i^2 + \varepsilon_i \quad (4)$$

Where  $\varepsilon_i$  is normally distributed and homoskedastic. The function form of (4) is dictated by the parameter  $\lambda$  which is estimated as the value that maximizes the log-likelihood function  $L(\lambda)$ .

$$L(\lambda) = -N/2 \ln \delta^2 + (\lambda-1) \sum \ln Y \quad (5)$$

In equation (5),  $\delta^2$  is the maximum likelihood estimates of the variance of the regression and  $N$  is the number of observations. Choosing  $\lambda$  and parameters to maximize equation (5) yield a value of  $\lambda_u$  (unrestricted) that equals approximately  $-0.012$ . Then, we use the likelihood ratio test to select the ideal functional form. The test statistics ( $\Omega$ ) for the restriction ( $\lambda_R$ ) against  $\lambda_u$  is defined as twice the difference in the logarithmic likelihood between null and alternative hypotheses and is distributed as  $\chi^2$  with degrees of freedom depending on the number of restrictions tested. The values of  $L(\lambda)$  corresponding to different (and selected) values of  $\lambda$  and their respective  $\Omega$  values are reported in Table 2. Since the critical  $\chi^2(1)$  for 95 per cent confidence level is 3.841, we accept the hypothesis that the estimates of semi-logarithmic form of the earnings equation is not significantly different from the unrestricted estimates. The Box-Cox non-linear regression estimates of the earnings function for  $\lambda$  equal to  $-0.012, 0$  and  $1$  are reported in Table 1. Since the semi-log form is appropriate, we consider the estimation results of the semi-logarithmic form in column 2. All the educational dummies are statistically significant at 1 per cent level. Except the indicators of ITI course, the remaining educational dummies influence the earnings positively. The coefficient of a dummy in education level shows the mean effect of a dummy vis-à-vis the left out variable. In other words, PhD holders are likely to earn 0.42 times more than the diploma holders are. Converting the coef-

ficients on the education dummies in to rates of result that the person with PhD degree receives 51.69 per cent higher income than a diploma holder receives. The post-graduate and under-graduate degree holders earn 39.51 per cent and 12.81 per cent of more income, while ITI people earn 23.94 per cent lower wages than the diploma holders. The marginal rate of return to PhD compared to Master degree is 12.18 per cent and that of master degree to U.G. degree is 26.70 per cent. The marginal return to U.G. degree compared with ITI is 36.75 per cent. Using (3), the marginal rate of return to investing one year at the level of PhD degree is computed as 3 per cent (12.18/4); the marginal returns for P.G. and U.G. degrees are 13.35 per cent (26.70/2) and 12.25 per cent (36.75/3) respectively. As expected, the experience (age)-earnings profile exhibits an inverted-U ( $\cap$ ) shape and the individual coefficients on experience and its squared term are statistically significant at 1-per cent level. In other words, the results show a clear non-linear relationship between work experience and income. The maximum return to experience is obtained at 28 years (by letting  $dY/dT=0$ ).

**Table 1:** Box-Cox Non-linear Regression Results Dependent Variable: Monthly Earnings

Explanatory Variables	Mean (S.D.)	$\lambda = 0.0$ (semi-log)	$\lambda = 1.0$ (linear)	$\lambda = -0.012$ (maximum)
	(1)	(2)	(3)	(4)
PhD	0.006 (0.079)	0.4167 (13.417)	5.3375 (12.009)	0.404 (13.452)
P.G.	0.139 (0.346)	0.3330 (32.670)	4.050 (29.047)	0.323 (32.677)
U.G.	0.635 (0.481)	0.1205 (18.207)	1.721 (17.940)	0.1167 (18.169)
ITI	0.036 (0.186)	-0.2737 (19.465)	-2.348 (11.780)	-0.2667 (19.536)
Diploma	0.183 (0.390)	-	-	-
Experience	12.008 (7.677)	0.0560 (42.139)	0.4916 (29.984)	0.0553 (42.241)
Experience <sup>2</sup>	-	-0.0010 (25.410)	-0.0042 (8.926)	-0.0008 (25.557)
Constant	-	1.1772	4.0049	1.6997
$\lambda$	-	0.0000 (0.000)	1.0000 (153.209)	-0.0123 (1.676)
$\delta^2$	-	0.1556	33.1690	0.14697
Log-likelihood	-	-80791.425	-90550.447	-80790.022
N	28567			

**Note:** 1. The mean of the dependent variable in 1166 and the standard deviation is 6.544.

2. Figures in the parentheses indicate the absolute t values.

2. Since the results of Box-Cox non-linear regression and the ordinary least squares are more or less the same, we use the former for interpreting the results.

**Table 2:** Summary of Likelihood Ratio Tests\*

$\lambda$	$L(\lambda_R)$	$\Omega = -2 [L(\lambda_R) - L(\lambda_U)]$
-0.05	-80803.266	26.408
-0.03	-80792.927	3.810*
-0.02	-80790.571	1.098*
-0.012 ( $=\lambda_U$ )	-80790.022	0.000*
-0.01	-80790.072	0.100*
0.00 (semi-log)	-80791.425	1.403*
0.01	-80794.629	9.214
0.05	-80825.873	71.702
0.10	-80906.203	232.360
0.50	-83202.856	4825.668
1.00 (linear)	-90550.447	19520.850

\* The hypothesis that  $\lambda_R$  is not significantly different from  $\lambda_U$  is accepted at 95 per cent confidence level.

# Estimates are obtained by Box-Cox Non-linear Regression Model using LIMDEP (version 6.0)

In addition, we also test whether the semi-logarithmic form of earnings equation which confirms with the basic assumption of multiple regression models, namely homoskedasticity. On the schooling dimension, we can choose the property that the error term is homoscedastic with respect to schooling by calculating the mean square errors of the residuals (MSR) from separate earnings regressions for different levels of education including experience and experience-squared as regressors. The estimated MSR for each category for both linear and semi-logarithmic specifications are given in Table 3. The results clearly imply the presence of severe heteroskedasticity (unequal variances) in the linear specification of the earnings equation. In the semi-logarithmic form however, no heteroskedasticity is detected.

**Table 3:** Mean Square Residuals by Schooling Levels

Schooling Level	No. of Sample	Linear (Y)	Semi-log (ln Y)
PhD	179	36.27	0.096
P.G.	3971	36.05	0.131
U.G.	18146	38.56	0.177
Diploma	5240	17.18	0.108
ITI	1031	6.66	0.114

On the experience dimension, the presence of heteroskedasticity is tested using the Goldfeld and Quandt test. The test statistics is estimated as 0.99 for the semi-logarithmic form and 2.00 for the absolute

linear term. The null hypothesis of homoscedasticity is accepted in the case of semi-logarithmic form while the same is rejected in the case of linear model<sup>3</sup>.

### Summary & Policy Implications

The rate of return to schooling is an important factor in determining educational attainment and participation and ultimately wages and income. The Mincerian earnings function is widely used to calculate the rate of return to education. However, there is a debate on the specification of the Mincerian model, concerning the functional form of the dependent variable. The empirical validity of using the semi-logarithmic form of the wage equation has not been tested in the Indian context. It is essential to determine the precise functional form of the wage equation because the mis-specified equation may provide misleading information pertaining to the policy matters.

**It is essential to determine the precise functional form of the wage equation because a mis-specified equation may provide misleading information pertaining to the policy matters.**

In this paper, we have estimated the returns to schooling for higher studies, using a large sample covering southern states of India. We have applied the flexible functional form estimator, known as Box-Cox transformation technique and the likelihood ratio test to select the ideal functional form the earning equation. The result implies that the appropriate regress and is the natural logarithm of the earnings, not the absolute income. Besides, the semi-logarithmic form also confirms the basic assumption of the regression model, namely homoskedasticity in both education and experience dimension.

The private rate of returns for PhD, P.G. and U.G. degrees are calculated at 51 per cent, 39 per cent and 13 per cent respectively. Given the results, higher earnings are associated with the higher level of education. However, the marginal rate of return to investing one year at the level of PhD degree is only 3 per cent; the marginal return for P.G. degree is about 13 per cent and

3. We have also tested the distribution of the residuals for normality in both cases. The distributions of both are significantly different from normal, but the distribution for semi-logarithmic regression is much more close to the normal where as the distribution in linear form is far more peaked and long-tailed.

for U.G. degree is 12 per cent. In general, the marginal rates for college and university studies in India are lower than the returns for below college level studies. Therefore, more investments and higher subsidies on the education below college level would be more beneficial for both individual and society than that on higher level. Usually, the government subsidies are high at higher level studies. Since the college and university studies are less remunerative, from the government point of view, it is better to reduce the subsidies and let the parents to bear the costs.

**More investments and higher subsidies on the education below college level would be more beneficial for both individual and society than that on higher level.**

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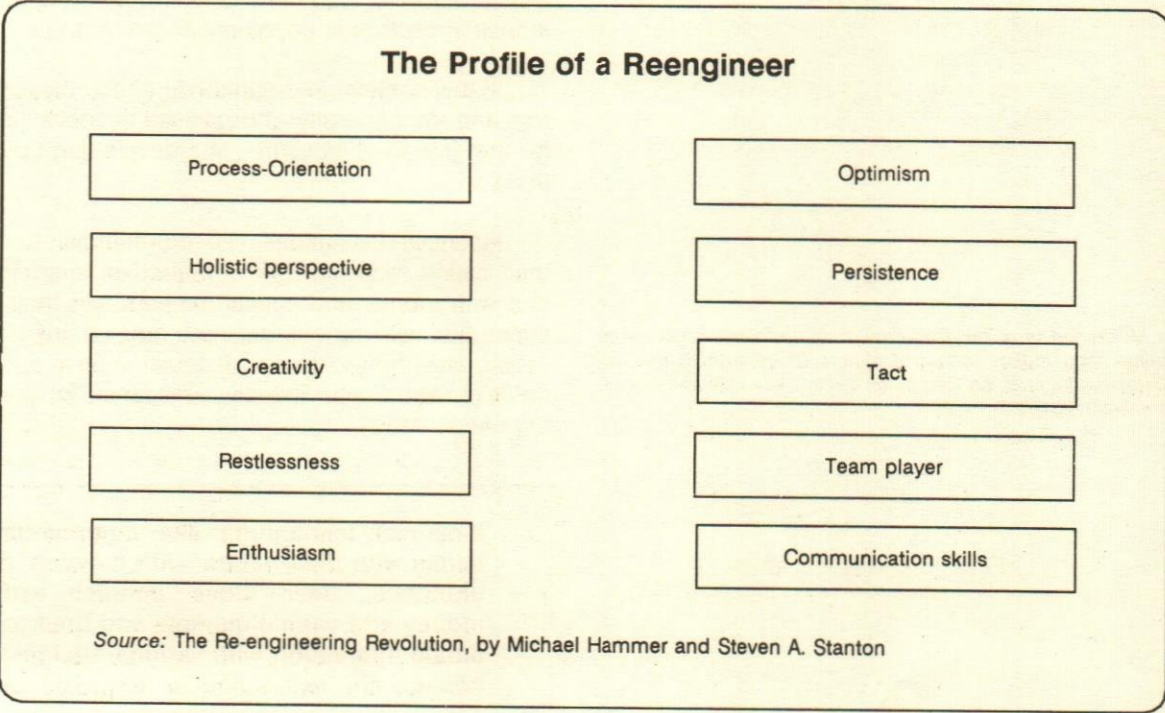
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# Multicriteria Loan Evaluation in Indian Banks: The Neural Network Approach

Kampan Mukherjee and Amlan Dattamandal

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*Loan Evaluation process involves analysis of Loan applications on the basis of both quantitative and qualitative criteria. In this paper an attempt is made to model the Multicriteria Loan Evaluation problem through BPN (Back Propagation Neural Network) approach with a case example taken from medium sized Indian banks.*

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## Introduction

Until independence, the banking system in India, which has been developed more or less on British pattern, concentrated on financing the working capital requirements of the trade and industry, remaining more or less aloof from providing term finance to industry. The requirements of term loans were catered to mostly by individual financiers and by entrepreneurs from their own profits in business and industry. Need for specialised institutions for meeting the long term financial requirements of industries has been felt, especially in the post-independence-era, after the initiation of planned economy. In particular, availability of finance and uninterrupted capital flow to industrial sectors is an essential pre-requisite.

In this context, Padmanabhan (1985) has shown the role and the necessity of organised financial institutions for the growth of industries in a developing country like India.

Financial institutions like commercial banks with their nation wide network of branches, their close contact with money and capital markets and their intimate interaction with various business houses are well-suited to appraise the prospects of industrial units and to offer them guidance and financial assistance for implementing the schemes.

**Financial institutions like commercial banks with their nation wide network of branches, their close contact with money and capital markets and their intimate interaction with various business houses are well-suited to appraise the prospects of industrial units.**

Granting loan to industrial sectors is considered to be a complex process involving various factors for consideration. Nationalised banks of India are to evolve techniques in accordance with the Government policy i.e., to fulfil social commitments e.g., employment generation, preference to self employment scheme to eradicate the unemployment problem, growth of Gross Domestic Product (GDP). Although the primary objective of the credit granting and loan evaluation is to maximise the firm's wealth, the socio-economic objectives are also to be stressed upon during decision making.

The basic factors which influence credit analysis are: character, capacity, capital and collateral of the borrowers. Nevertheless appraisal of loan applications requires a systematic review of technical, economic, financial and organisational issues of the project to ensure that it is technically sound and consistent with overall economic objectives of the country and would also yield appropriate financial return. The appraisal should also identify the weakness and deficiencies, if any, in the preparation of the project and to what extent and in what manner the project can be strengthened or improved upon.

**The basic factors which influence credit analysis are: character, capacity, capital and collateral of the borrowers. Nevertheless appraisal of loan applications requires a systematic review.**

The main objective of this paper is the critical analysis of loan evaluation decision problem in Indian banking industry. It includes a methodology involving Neural Network approach for solving this multidimensional managerial task.

### **Analysis of Loan Evaluation Process**

In general the process of loan evaluation and project appraisal can be broadly characterised by the study and analysis of the projects on Technical feasibility, Economic viability and Management feasibility (Dudhmal, 1985) of the projects. These feasibility studies involve the assessment on the following issues related to each loan proposal (Desikan and Shekar, 1993).

*Technical feasibility:* Transportation, availability of power, availability of water, availability of labour, land and building, selection of technology, requirement and

availability of raw material, requirement and availability of plant and machinery, product mix and capacity.

*Economic Viability:* Demand and supply of the product, marketability, profitability, fixed capital requirement, working capital requirement, annual production, annual turnover, return on investment (ROI) and employment generation.

*Management feasibility:* Behaviour and nature of the entrepreneur, contribution, financial resource, competence, leadership, self-confidence/motivation, organisation's structure, previous experience, integrity.

In appraising the organisational, managerial, and operational aspects of a project, the bank is particularly interested in the competence of the management in implementing the project and in operating it after implementation (Rotberg, 1976). Already a wide range of approaches have been proposed for formalisation and rationalisation of loan evaluation decision. Some of these approaches focus mainly on multidimensional analysis of the problem which ultimately leads to mathematical modelling of the loan evaluation problem. Although McKinnon (1985) proposes an ordered flow chart for loan analysis, most of the approaches under this category attempts to formulate multidimensional model for this purpose.

**In appraising the organisational, managerial, and operational aspects of a project, the bank is particularly interested in the competence of the management in implementing the project and in operating it after implementation.**

One form of integrated financing and investment model is the development of simulation models or rather financial statement generators in which the data processing capability of computer is used to analyse the impact of alternative strategies. The other form is the formulation of the investment and financing opportunities as a mathematical programming model. In the approach the model is used to maximise one particular financial criterion subject to a set of constraints. The third methodology, that capitalised on the advantages of both the financial statement generator and mathematical programming models is the vector maximisation or multicriteria programming model (Ashton and Atkins, 1979).

Multidimensional Scaling technique justifies incorporation of both the cost benefit analysis and utility

theory in multicriteria loan evaluation problem. Clark and Rivett (1978) explain Multidimensional Scaling method as an approach of representing  $n$  objectives (policies) by  $n$  equivalent points in  $t$ -dimensional Euclidean space in such a way that the distance between two points  $i$  and  $j$  :  $d_{ij}$  corresponds in some sense to the observed or measured dissimilarities between the objects  $i$  and  $j$ . Herein the more similar objects are, closer they are in the geometric configuration.

A more general and fundamental approach in loan analysis may be the understanding of the behavioural traits that play an important role in investment decision. The main focus in such an approach is investor's attitude towards the risk involved in an investment activity. Use of a risk questionnaire can facilitate a dialogue between the investment managers and the institutional clients on the topic of risk tolerance (Baron, 1989). Loan evaluation problem may also demand a macro level analysis involving the national policy formulating agencies, especially for developing countries like India (Ray and Herman, 1979). "Having special groups assigned to review matters requiring special attention... prove to be quiet effective for repayment and control over loan management" (Bosma, 1987).

Application of Artificial Intelligence enhances the quality of decision making process providing intelligent, analytical and reasoning support in real time and interactive method. It has been recognised that an Expert System may be suitably used as a decision aid tool for financial decision making (Holsapple, *et al*, 1988).

**Application of Artificial Intelligence enhances the quality of decision making process providing intelligent, analytical and reasoning support in real time and interactive method.**

An ongoing effort has been the development of a knowledge-based decision support system, for evaluating commercial loan applications. The system (Shand and Gentry, 1988) is referred as MARBLE, (Managing and Recommending Business Loan Evaluation). This is user-friendly and is based on rules widely accepted by commercial lending officers. Inductive learning in MARBLE is a process of inferring the description of specific loan from the description of individual objectives of the class e.g. financial ratios and/or relationship that exists among quantitative or qualitative information.

CLASS (Commercial Loan Analysis Support System) is another expert system which uses rules and heuristics obtained from a commercial lending expert to analyse the four Cs of lending i.e. credit, collateral, capital and capacity (Duchessi, *et al*, 1988). It also generates a report, providing full documentation of the loan decision. Furthermore, Mukherjee and Mondal (1994) propose a Multiattribute DSS approach for project selection decision. It involves integration of quantitative and qualitative criteria along with the degree of importance obtained from the decision maker interactively. The judgment of the decision maker is also incorporated in rating the projects by qualitative criteria. The proposed model can easily be used for the loan evaluation problem which is characterised as multiple criteria decision making.

Artificial Neural System (ANS), an Artificial Intelligence tool is a computer programme that simulates the process by which human learning and intuition take place (Hawley *et al*, 1990). ANS does not rely only on a pre-programmed knowledge base. Rather, it learns through experiences, and is able to continue learning as the problem environment changes. ANS is well suited to deal with unstructured problems, inconsistent information and real time output. In the area of finance, some potential applications include assessment of bankruptcy risk, identification of arbitrage opportunities and technical and fundamental analysis. ANS could be trained using customer data as input vector and the actual decision of the credit analysis as the desired output vector. The objective of the system would be to mimic the human decision maker in granting or revoking credit and setting credit limits.

## Neural Networking

### *Conceptual paradigm of Neural Network*

Neural Network is a problem solving method or tool, particularly for simulating intelligence in pattern detection, association and classification of activities. Neural Net learns from experiences, generalises from previous examples to new ones and performs the forecasting exercise with a new set of input data. Application of Neural Networks has advantages on several senses.

**Neural Network is a problem solving method or tool, particularly for simulating intelligence in pattern detection, association and classification of activities.**

Firstly, they are adaptive; they can take data and learn from it. Thus they infer solutions from data presented to them, after capturing very subtle relationships.

Secondly, Neural Networks can generalise. Generalisation is useful in practical applications because real world data is noisy.

Thirdly the Networks are nonlinear, in that they can capture complex interactions among the input variables in a system.

Fourthly, Neural Networks are highly parallel, numerous identical, independent operations can be executed simultaneously.

The PDP (Parallel Distributed Process) models based on use of large numbers of elemental processors interconnected in manners reminiscent of human Neural Nets can exhibit powerful learning, memorisation and associative recall capabilities for pattern formatted information. Decisions made by human being are generally based on subjective probability rather than an objective probability. The act of classification in pattern recognition rests on the degree of belief that the pattern in question is indeed a member of certain class. This belief should be considered to depend on three entities, the evidence, hypothesis and the state of mind of the decision maker. Neural Networks or connectionist nets, that are excellent for examining many options in parallel, involve representing knowledge in the form of patterns or arrays. This knowledge is acquired during the training/learning phase of the pattern recognition.

### **Feed Forward Back Propagation Network**

The conceptual basis of back propagation was first presented in 1974 by Paul Werbos and then independently rediscovered around 1985 by Rumelhart, Hinton and Williams. Again Le Cun in 1985 proposed a related algorithm (Hertz). Various algorithms have been developed for adjusting the weights of connecting units in successive layers of a multi-layer Network.

In this method, the Network learns to give a desired output vector in response to the input following propagate-adapt cycle. After an input vector has been applied as stimulus to the first layer of Network units, it is propagated through each upper layer until an output is generated. This output pattern is then compared with a desired output and an error signal is computed for each output unit. The error signals are transmitted back from the output layer to each node in the intermediate layer that contributes directly to the output. The process

repeats until each node in the Network has received an error signal that describes its relative contribution to the total error. Based on the error signal received, connection weights are updated by each unit to cause the Network converge towards a state that allows all training pattern to be encoded (Pao Yoh-Han, 1989):

**1 cycle = 2 passes: Forward pass to determine error, Backward pass to modify weights & correct error. [Output - Desired output = Error]**

Uniqueness of the back propagation algorithm is its ability to change its weights in response to the errors during training. Training requires a series of input patterns tagged with their desired output patterns.

### **System Design and Simulation Methodology**

The equation that changes the weights, the delta rule, is designed to minimise the Network's sum-squared error. The weights are saved to preserve what the Net has learned. After the training, the Network is tested for reliability in its application with some known data other than that was used during the training.

*The Generalised Delta Rule for the Semilinear Feed Forward Net with Back Propagation of Error may be modelled as follows:*

A set of inputs are applied, either from outside or from previous layer of the Net. Each of these inputs is multiplied by a weight and the products are summed. The summation of the product is termed as NET. An activation function F is applied to modify the output signal of NET - OUT.

Activation function for Back Propagation is generally Sigmoid i.e. it has simple derivative. For any input-output function which has a bounded derivative,

$$\delta_{OUT} / \delta_{NET} = OUT (1-OUT) \quad (1)$$

known as squashing function. Sigmoid compresses the range of NET, so that OUT lies between zero and one. Squashing function produces needed linearity.

The input-output sets are expressed in vector form. All the weights are initialised with a set of small random numbers. The algorithm based on the generalised delta rule follows two phases:

#### **First phase (Forward pass)**

An input vector  $\vec{X}$  is applied and an output vector  $\vec{Y}$  is produced. The input-target vector pair X and T

are obtained from training set. For multi-layered Network, the NET value of each neuron in the first layer is calculated as the weighted sum of its neuron's inputs. Activation function  $F$  then squashes NET to produce the OUT for neuron in that layer. The set of outputs of a layer serves as inputs to the next layer. The process is repeated until final Network output is produced.

The weights between neurons can be considered to be a matrix  $W$ . The NET vector for a layer  $N$  is expressed as the product of  $X$  and  $W$ :

$$\vec{N} = \vec{X} * \vec{W} \quad (2)$$

Applying the function  $F$  to the NET vector  $N$ , component by component, output vector  $O$  is produced.

$$\vec{O} = \vec{F}(\vec{X} * \vec{W}) \quad (3)$$

### Second phase (Reverse phase)

Herein associated weights are adjusted using Back Propagation: For a weight between neuron  $p$  in hidden layer  $j$  and neuron  $q$  in the output layer  $k$ , the output of the neuron in layer  $k$  is subtracted from its target value to produce an error signal. This multiplied by the derivative of the squashing function  $[OUT(1 - OUT)]$  generates the value  $\delta$  for that neuron.

$$\delta = OUT(1 - OUT) * (Target - OUT) \quad (4)$$

$\delta$  is then multiplied by OUT of the source neuron  $j$ . This product is then multiplied by a training rate co-efficient  $y$  [0.01 to 1.0] and the result is added to the weight.

Identical process is performed for each weight preceding from a neuron in the hidden layer to a neuron in the outer layer as:

$$\Delta W_{pqk} = y\delta_{qk} OUT_{pj} \quad (5)$$

$$W_{pqk}(n+1) = W_{pqk}(n) + \Delta W_{pqk} \quad (6)$$

$W_{pqk}(n)$ : Weight between neuron  $p$  in the hidden layer and neuron  $q$  in the output layer at the step  $n$  before adjustment

$W_{pqk}(n+1)$ : Weight at step  $(n+1)$  after adjustment

$\delta_{qk}$ : Value of  $\delta$  for neuron  $p$  in output layer  $k$

$OUT_{pj}$ : Value of OUT for neuron  $p$  in the hidden layer  $j$ .

In many cases, it is desirable to provide each neuron with a trainable bias-permitting more rapid convergence of the training process. It is applied in the training algorithm.

Momentum, a factor, which is proportional to the amount of previous weight changes is also added to the weight adjustment equation. This is remembered and serves to modify all subsequent weight adjustments. And the modified weight adjustment equation transforms to:

$$W_{pqk}(n+1) = y(\delta_{qk} OUT_{pj}) + \alpha [\Delta W_{pqk}(n)] \quad (7)$$

$\alpha$ : Momentum coefficient, commonly set to 0.9

$y$ : Training rate coefficient

### Case Study

The above mentioned Neural Network modelling and simulation approach is validated through solving loan evaluation problem for Indian Banks. The case example has been developed involving four district level branches of premier nationalised banks and one state level financial corporation in the state of West Bengal. Quite a few managers and technical officers from these five financial institutions have been contacted. The existing procedures for loan appraisal have been studied and the relevant data have been collected through a series of interviews. The four banks e.g. the State Bank of India, two branches of Allahabad Bank and United Bank of India have the authority of dealing with a financial proposal within a maximum limit of Rs. 5 lakhs. The West Bengal Financial Corporation (WBFC), is a state level financial corporation, established to promote the industries in the state of West-Bengal provides with term loan facility to the small scale as well as large scale industries with a maximum limit even over Rs. 1 crore. The corporation is to look into the details of the project and study the project viability. The institution is also accountable to the State Government for the real achievement of industrial development in the state. The five financial houses have their own application forms comprising details of the project, further they also follow a questionnaire method for judging the integrity, motivation and other managerial capability of the entrepreneur. For this purpose the WBFC also has a technical wing to study the technical, economic, and the management feasibility. It has a network of branches in each district Sadar towns and other important towns in the state. The former four financing institutions are the district level branches of the four nationalised banks as mentioned earlier. Though these branches are mainly engaged in day-to-day banking transaction and customer services,



they are also entrusted with the job of financing the small scale sectors in order to fulfil the objectives and industrial policies of the Government. The loan applications exceeding Rs. 5 lakhs are forwarded to their state level head offices for feasibility and viability analysis.

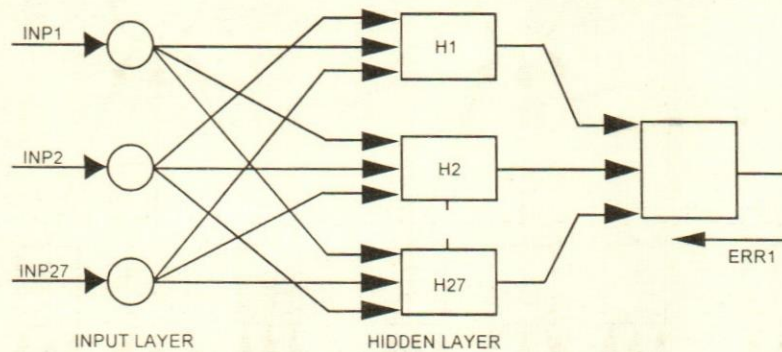
Broadly, two sets of data have been collected for the above endeavour—one for learning of the Neural Net and the other for its testing. The basic assumption in this Neural Network development lies in the fact that although there may be variations in decision making styles among the above mentioned five financial institutions, the policy, the managerial culture and the overall orientation of corporate strategy for these five units are grossly similar. In fact all these five units are nationalised units and the general developmental policy of Government plays the main role in corporate decision making at all these five units.

Moreover for loan appraisal, each of the three main feasibility criteria i.e. technical, economic and management, is subdivided into nine sub-criteria as mentioned in earlier chapter. In this paper two alternative Neural Net architectures are proposed. In Module-I (Fig. 1), all the 27 sub-criteria are considered simultaneously for the selection of the most viable credit application. On the other hand the

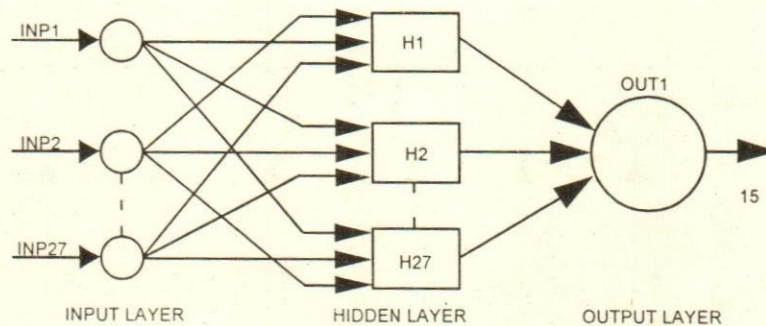
Moreover for loan appraisal, each of the three main feasibility criteria i.e. technical, economic and management, is subdivided into nine sub-criteria as mentioned.

second alternative architecture i.e., Module-II (Fig. 2) involves two phases of operations. In the first phase the Neural Net identifies viability of a project in terms of each of the three main feasibility criteria separately. Thus it includes nine parameters for each of the feasibility criteria. Subsequently, in the second phase the ultimate project viability is measured on the basis of the degree of feasibility in terms of the three criteria which are nothing but the outcome from Phase-I of Module-II.

For learning purpose of the above two different architectures of the Neural Net, six hypothetical loan projects have been chosen through discussion with the executives and managers of the above five financial institutions. The decision makers were supposed to respond for each of the six projects on a [0, 1] scale. As a result of an extensive interview session,

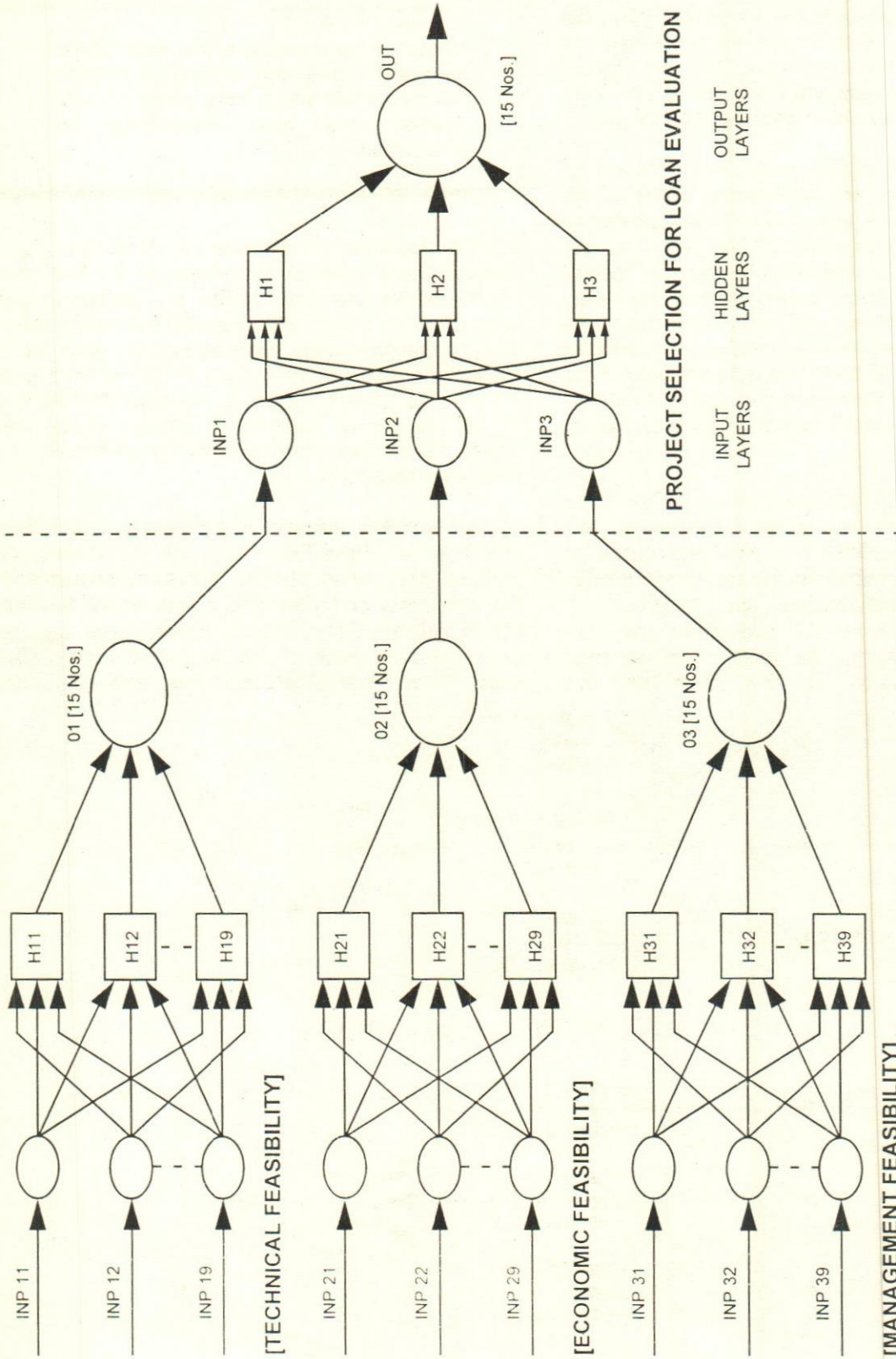


NET ARCHITECTURE FOR LEARNING 6 SAMPLES



NET ARCHITECTURE FOR TESTING 15 SAMPLES

Fig. 1. [Module I]



Phase-II [Learning: 6 Samples; Test: 15 Samples]

Fig. 2 [MODULE II]

Phase-I: [Learning: 6 Samples(each); Test: 15 Samples(each)]

**Table 1:** Learning parameters for project viability of Module-I and for technical feasibility, economic feasibility, management feasibility for Phase-I in Module-II

Learning Parameters for Decision Making	Learning Data Set: Scale [0-1]					
	1	2	3	4	5	6
<b>[A] Technical Feasibility:</b>						
Transportation	1.0	0.5	0.0	1.0	1.0	1.0
Availability of power	1.0	0.5	0.00	0.5	0.5	1.0
Availability of water	1.0	0.5	0.0	0.5	0.5	1.0
Availability of labour	1.0	0.5	0.0	1.0	0.0	0.5
Land and building	1.0	0.5	0.0	1.0	0.0	0.5
Requirement and availability of raw material	1.0	0.5	0.0	0.5	0.5	1.0
Selection of technology	1.0	0.5	0.0	0.5	0.5	1.0
Requirement and availability of plant/ machinery	1.0	0.5	0.0	1.0	0.0	1.0
Product mix and capacity	1.0	0.5	0.0	0.5	0.0	1.0
Output (Desired): Phase-I/Module-II	1.0	0.5	0.0	0.5	0.0	1.0
<b>[B] Economic Feasibility:</b>						
Demand and supply of the product	1.0	0.5	0.0	1.0	1.0	1.0
Marketability	1.0	0.5	0.0	1.0	1.0	1.0
Profitability	1.0	0.5	0.0	0.5	0.5	1.0
Fixed capital requirement	1.0	0.5	0.0	1.0	0.0	0.5
Working capital requirement	1.0	0.5	0.0	1.0	0.0	0.5
Annual production	1.0	0.5	0.0	0.5	0.5	1.0
Annual turnover	1.0	0.5	0.0	0.5	0.5	1.0
Return on investment	1.0	0.5	0.0	1.0	0.0	1.0
Employment generation	1.0	0.5	0.0	0.5	0.0	1.0
Output (Desired): Phase-I/Module-II	1.0	0.5	0.0	0.5	0.0	1.0
<b>[C] Management Feasibility:</b>						
Behaviour and nature	1.0	0.5	0.0	1.0	1.0	1.0
Self contribution	1.0	0.5	0.0	0.5	0.5	1.0
Financial resources	1.0	0.5	0.0	0.5	0.5	1.0
Competence	1.0	0.5	0.0	1.0	0.0	0.5
Leadership	1.0	0.5	0.0	1.0	0.0	0.5
Confidence/motivation	1.0	0.5	0.0	0.5	0.5	1.0
Organisational structure	1.0	0.5	0.0	0.5	0.5	1.0
Previous experience	1.0	0.5	0.0	1.0	0.0	1.0
Integrity	1.0	0.5	0.0	0.5	0.0	1.0
Output (Desired): Phase-I/Module-II	1.0	0.5	0.0	0.5	0.0	1.0
Aggregated Output (Desired): 27-inputs altogether for Module-I	1.0	0.5	0.0	0.5	0.0	1.0

**Table 2:** Learning parameters for aggregate decision making i.e. project evaluation for loan approval of Phase-II in Module-II

Learning Parameters for Decision Making	Learning Data Set: Scale [0-1]					
	1	2	3	4	5	6
Technical Feasibility	1.0	0.5	0.0	1.0	0.0	0.5
Economic Feasibility	1.0	0.5	0.0	0.5	0.5	1.0
Management Feasibility	1.0	0.5	0.0	0.5	0.0	1.0
Output: (Desired) for Phase-II/Module-II	1.0	0.5	0.0	0.5	0.0	1.0

the decision makers evaluate the six projects in terms of 27 sub-criteria (for Module-I) and 9 criteria (for Module-II). For learning purpose, alongwith the data for input parameters, the decision makers also provide their decision in terms of viability of the projects which are treated as desired output for different decision situations. These input-output parameters are used for learning of the Neural Net for the two alternative models. The input-output data sets are shown in the Table 1 (Module-I & Module-II/Phase-I) and Table 2 (Module-II/Phase-II).

Three real life projects from each of the five financial institutions (i.e. 15 total loan evaluation projects) were identified for testing of the above two modules. Corresponding values of all the relevant input parameters were collected on the basis of decision makers' responses through a series of interviews with the executives and managers of the financial institutions. Further, the decision makers were also asked to give their actual decisions which were used for the comparison and validation of Neural Net modules. All these data are displayed in Table 3 (Module-I and Module-II/Phase-I) and Table 4 (Module-II/Phase-II).

Figures 1 and 2 show the difference in architectural paradigm of Module-I and II. As discussed earlier, Module-II involves two phases—first phase is criteria-wise feasibility analysis whereas the second one is ultimate selection of the most viable project on the basis of the three main criteria.

The learning of the modules is conducted applying the simulation algorithm as described earlier. The Network convergency was achieved within 2000 iterations. The output of the testing session for each of the two Modules is shown in Table 5. This table also includes the corresponding actual decisions made by the decision makers. On the basis of this result it is quiet apparent that the outputs from Module-II more closely resemble the actual decision.

**Table 3:** Test parameters for decision making i.e. loan evaluation of Module-I and for technical feasibility, economic feasibility, management feasibility separately of Phase-I/Module-II

Test Parameters for Decision Making	Test Data Sets: Scale [0-1]														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
<b>Technical Feasibility:</b>															
Transportation	0.5	0.5	0.5	0.8	0.6	0.3	0.5	0.5	0.5	0.5	0.5	0.3	1.0	0.5	0.5
Availability of power	0.5	0.5	0.5	0.8	0.8	0.5	1.0	1.0	0.5	0.7	0.5	0.4	0.5	1.0	0.5
Availability of water	0.5	0.2	0.2	0.5	0.5	0.4	0.5	1.0	1.0	0.5	0.5	0.5	1.0	0.5	0.4
Availability of labour	0.2	0.2	0.2	0.4	0.6	0.3	1.0	1.0	0.5	0.6	0.5	0.3	0.5	1.0	0.3
Land and building	0.5	0.5	0.5	0.8	0.8	0.4	0.5	0.5	0.5	0.7	0.5	0.4	1.0	1.0	0.4
Raw Material	0.6	0.5	0.2	0.8	0.6	0.5	0.5	0.5	0.5	0.7	0.5	0.3	1.0	1.0	0.5
Selection of technology	0.7	0.5	0.4	0.8	0.5	0.3	0.5	0.5	0.5	0.7	0.7	0.7	0.5	1.0	0.4
Plant and machinery	0.5	0.6	0.5	0.8	0.8	0.6	1.0	1.0	1.0	0.5	0.5	0.5	0.5	0.5	0.3
Product mix and capacity	0.6	0.5	0.4	0.5	0.5	0.3	0.5	0.5	0.5	0.7	0.6	0.4	1.0	0.4	0.1
<b>Output: Phase-I/Module-II</b>	0.7	0.3	0.1	0.8	0.7	0.2	0.9	0.9	0.9	0.9	0.7	0.4	0.9	0.9	0.1
<b>Economic Feasibility:</b>															
Demand and supply of product	0.7	0.5	0.5	0.8	0.6	0.5	0.5	1.0	0.5	0.5	0.5	0.5	1.0	1.0	0.5
Marketability	0.7	0.5	0.5	0.8	0.5	0.4	0.5	1.0	0.5	0.6	0.6	0.5	0.5	0.4	0.4
Profitability	0.8	0.5	0.3	0.5	0.8	0.4	0.5	1.0	1.0	0.6	0.6	0.5	0.5	0.5	0.1
Fixed capital requirement	0.5	0.5	0.5	0.8	0.4	0.4	1.0	1.0	0.5	0.7	0.6	0.4	0.5	0.5	0.3
Working capital requirement	0.5	0.5	0.5	0.4	0.8	0.5	1.0	0.5	0.5	0.7	0.6	0.4	0.5	0.5	0.3
Annual production	0.5	0.5	0.5	0.5	0.7	0.5	0.5	0.5	0.5	0.6	0.6	0.3	1.0	0.5	0.4
Annual turnover	0.5	0.5	0.5	0.6	0.8	0.1	0.5	0.5	1.0	0.8	0.5	0.5	0.5	0.5	0.3
Return on investment	0.6	0.5	0.4	0.5	0.8	0.5	0.5	1.0	0.5	0.8	0.6	0.5	1.0	1.0	0.4
Employment generation	0.5	0.4	0.4	0.7	0.5	0.0	1.0	0.4	0.1	0.1	0.6	0.3	1.0	0.5	0.3
<b>Output: Phase-I/Module-II</b>	0.6	0.4	0.2	0.8	0.8	0.1	0.9	0.8	0.1	1.0	0.8	0.2	0.9	0.3	0.1
<b>Management Feasibility:</b>															
Behaviour and nature	0.5	0.5	0.5	0.8	0.6	0.3	0.5	0.5	0.5	0.5	0.5	0.3	1.0	0.5	0.5
Self contribution	0.5	0.5	0.5	0.5	0.5	0.0	0.5	0.5	0.1	0.7	0.6	0.4	1.0	0.7	0.1
Financial resources	0.7	0.5	0.3	0.5	0.5	0.1	1.0	0.5	0.2	0.8	0.8	0.8	1.0	1.0	0.1
Competence	1.0	0.7	0.4	0.7	0.5	0.5	0.5	1.0	1.0	0.8	0.5	0.5	1.0	0.5	0.5
Leadership	0.8	0.5	0.2	0.5	0.7	0.5	0.5	0.5	0.5	0.7	0.6	0.5	1.0	1.0	0.1
Confidence/motivation	0.7	0.7	0.2	0.7	0.7	0.4	0.7	0.5	0.4	0.5	1.0	0.5	1.0	0.5	0.3
Organisational structure	0.6	0.5	0.5	0.5	0.6	0.4	0.6	1.0	0.5	0.5	0.5	0.4	0.5	0.5	0.5
Previous experience	1.0	0.5	0.4	0.8	0.5	0.3	0.7	0.5	0.5	0.7	0.6	0.3	0.7	0.5	0.5
Integrity	1.0	0.5	0.5	0.6	0.5	0.3	1.0	0.5	0.1	0.8	0.7	0.4	1.0	0.5	0.2
<b>Output: Phase-I/Module-II</b>	1.0	0.5	0.2	0.8	0.5	0.1	0.9	0.8	0.1	0.9	0.9	0.2	1.0	0.7	0.1
<b>Output for Decision Making Loan Evaluation: Module-I</b>	0.8	0.3	0.2	0.8	0.7	0.1	0.9	0.8	0.3	0.9	0.8	0.2	1.0	0.8	0.1

Sources: [1] West Bengal Financial Corporation (WBFC), Calcutta, West Bengal; [2] State Bank of India (SBI), Bolpur Branch, West Bengal; [3] Allahabad Bank (AB-I), Santiniketan Road Branch, West Bengal; [4] Allahabad Bank (AB-II), Bolpur Branch, West Bengal; [5] United Bank of India (UBI), Bolpur-Santiniketan Branch, West Bengal.

**Table 4:** Test parameters for decision making i.e. loan evaluation of Phase-II/Module-II

Test Parameters for Decision Making	Projects: Scale [0-1]														
	WBFC			SBI			AB-I			AB-II			UBI		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Technical Feasibility	0.7	0.3	0.1	0.8	0.7	0.2	0.9	1.0	0.9	0.9	0.7	0.4	0.9	0.9	0.1
Economic Feasibility	0.6	0.4	0.2	0.8	0.8	0.1	0.9	0.8	0.1	1.0	0.8	0.2	0.9	0.3	0.1
Management Feasibility	1.0	0.5	0.2	0.8	0.5	0.1	0.9	0.8	0.1	0.9	0.6	0.2	1.0	0.8	0.1
Output for Loan Evaluation: Phase-II/Module-II	1.0	0.4	0.1	1.0	0.8	0.0	1.0	0.8	0.0	1.0	0.9	0.0	1.0	0.9	0.1

Source: The simulation outputs of Phase-I/Module-II in table 3.

**Table 5:** Comparative statement of the outputs of Module-I and Module-II (Net Architecture)

Simulation Outputs:	Projects for Loan Evaluation: Scale [0-1]														
	WBFC			SBI			AB-I			AB-II			UBI		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Module-I	0.8	0.3	0.2	0.8	0.7	0.1	0.9	0.8	0.3	0.9	0.8	0.2	1.0	0.8	0.1
Module-II	1.0	0.4	0.1	0.1	0.8	0.0	1.0	0.8	0.0	1.0	0.9	0.0	1.0	0.8	0.1
Actual Decision	1.0	0.5	0.0	1.0	0.6	0.0	1.0	0.7	0.0	0.9	0.8	0.0	1.0	0.7	0.2

Rating Criteria for Project Viability: [1.0] – Very Good; [0.5] – Good; [0.0] – Bad

## Conclusions

This paper attempts to propose Neural Net as a model for guiding the loan evaluation decision in financial houses. Loan evaluation decision, inherently a multicriteria decision situation is characterised by complex human cognitive effort involving experience of the experts, which ultimately generates the appropriate degree of importance of different criteria of viability and their complex interactions. Conceptually, Neural Net, being an A.I. tool, tends to replace the human decision makers. But use of Neural Net model may be very aptly applied as a supporting frame work for taking appropriate loan evaluation decision. Being a model representing expert's opinion, this also provides sufficient guidance to a bank manager in improving his decision making skill.

The above effort however is affected by some of the drawbacks which are inherent in neural networking. Firstly, the reliability of the model entirely depends on the exactness of the human responses which are used for the training of the model. Secondly, there exists the problem of falling in local minima in Back Propagation method. Thirdly, neural net generally consumes huge amount of computer time and thus costs very high especially during training.

Moreover, all though generalised delta rule has been used for the training of the model, there is enough

scope for development of a more appropriate algorithm for training of Neural Nets. Further research should improve the understanding of how to design and train Neural Networks properly. Nevertheless, the study shows the Module-II represents a relatively realistic framework for loan evaluation decision by decision makers. This perhaps is due to the fact that in case of a complex decision environment, disintegration to different phases improves the effectiveness of the model. The above model could be extended involving more decision factors and more training cycles to arrive at a relatively more effective model for loan evaluation decision.

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□

*Too many companies start re-engineering without trying to build the energy within themselves to change.*

— Anil Sachdev

# Stress, Strain and Coping Styles Among Air Traffic Controllers

Satishchandra Kumar, Rupali Kulkarni and Omer Bin Sayeed

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*A study of stressors, strain and coping styles among Air traffic controllers at Mumbai airport was undertaken. The sample consisted of 40 air traffic controllers. The age of respondents ranged from 25 to 54 years with a mean age of 34.33 years. A list of 14 stressors, strains and coping strategies was chosen on the basis of a pilot study conducted on eight air traffic controllers. The respondents were asked to rate the 14 stressors, strains and coping strategies on a 5 point rating scale. The data were analysed by using percentages and Chi square technique. Results indicated that the salient stressors among air traffic controllers were lack of housing and welfare facilities, low monetary incentives, problems of equipments, maintenance transfers and shift duties. Disturbance in circadian rhythm, sleep disturbance and tensions were the major strains experienced by the air traffic controllers. The strategies ATCs used to cope with stress include: analysing the situation logically, developing a positive attitude and resorting to watching television/other entertainments. The results are also discussed in the context of other studies.*

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## Introduction

Pilots and air hostesses usually enjoy the limelight in the civil aviation industry. One professional group which performs a very critical function but stands largely ignored in India is the air traffic controllers (ATC). A pilot is only responsible for a single aircraft which he is flying. Though he must be given due credit for the stress and pressures that such a responsibility entails, the ATCs are responsible for a number of aircrafts at the same time. An ATC is, therefore, accountable to a number of people, which tends to increase his job demands, pressures and creates long lasting stressful conditions.

According to the International Civil Aviation Organisation (1987), the prime objectives of air traffic services shall be to:

- Prevent collisions between aircraft,
- Prevent collisions between aircraft on the maneuvering area and obstruction on that area,
- Expedite and maintain an orderly flow of air traffic,
- Provide advice and information useful for the safe and efficient conduct of flights,
- Notify appropriate organisations regarding aircraft in need of search and rescue aid, and assist such organisations as required.

**In civil aviation, safety is paramount in functioning both in air and on the ground and air traffic controllers have a great role to play in ensuring safe airspace management and control of sky.**

In civil aviation, safety is paramount in functioning both in air and on the ground and air traffic controllers have a great role to play in ensuring safe airspace management and control of sky. Thus, the essential role of air traffic controllers has been described as *converting traffic demands into traffic flow*.

In earlier days, the responsibility for aircraft safety was placed on the pilot and was based purely on a "see and be seen" principle. The increasing size and speed of aircrafts and the congestion of the air space necessitated the establishment of a separate system to maintain safety and facilitate navigation in skies. Thus the first air traffic control system was established in 1935 at Cleveland, New York, and Chicago. The ATC's are well trained professionals whose role calls for high degree of alertness, presence of mind, swift action, and they have to ensure the coordination of all organisations associated with flight safety.

In India, the ATC department has five different units, viz., surface movement control, control tower, approach radar or approach control, area control center and flight information center.

In 1993, the Government of India announced 'The Open Sky Policy' in civil aviation. As a result of this liberalization policy there has been an entry of several private airline companies into the aviation business resulting in an enormous increase of flights and consequently an increase in air traffic. Such a situation directly translates into increased pressure and work overload for the ATCs.

Mumbai, India's commercial capital has a flight information region (FIR) stretching to 1.2 lakh square kms, making it the biggest FIR in South Asia. Yet it operates with a single runway (technically, Mumbai has two runways, but they cannot be used simultaneously because they intersect each other in the middle). Being the busiest airport in the country, Mumbai handles more than 320 flight movements per day (24 hours) in addition to 100 flights which overfly. Besides, regular flight the ATCs at Mumbai also have to handle helicopter movements from Juhu and the oil rigs at Mumbai high and also the naval helicopters. This adds tremendously to their work load, as managing helicopter movements is very time consuming.

### Occupational Stress

Stress is a dynamic condition in which an individual is confronted with an opportunity, constraints or demands related to what he/she desires for which the outcome is both uncertain and important (Schuler, 1980).

Stress includes three aspects—stressors, strains and coping strategies. Stressors are those factors within the individual or from the external environment, which are conducive to stress. Strain is a state of being stressed. In other words, the term stressor usually refers to the environmental stimulus and the term strain to the individual response. Strain can be physiological, psychological or behavioural but it is by definition an indicator of ill health or well being of an individual. Coping behaviours are an important aspect of the stress process. It is aimed at reducing stress. Coping has been defined as "efforts at stress management" (Cohen and Lazarus, 1979) "things that people do to avoid being harmed by life strains" (Pearlin and Schooler, 1978) and "overt and covert behaviours that are taken to reduce or eliminate psychological distress or stressful conditions" (Fleishman, 1984).

In recent years attempts have been made to trace stresses among professional groups in India such as researchers, doctors, nurses, social workers, school teachers, university and college teachers, managers, Gazetted officers, Bank managers, entrepreneurs, (Pestonjee, 1992). But still there are many job categories and professional groups where more research studies are needed. One such professional group, where there is a dearth of studies is of Air Traffic Controllers.

Studies conducted in the west have revealed that the ATCs job is highly stressful (Grandjean, 1968; Grandjean and Wotzka, 1971; Krol, 1971; Repetti Rena, 1993).

Crump, Cooper and Maxwell (1981) reported that primary short term but uncontrollable stressor for ATCs is workoverload. It is also found that there is a direct and predictable relationship between the workload of a pilot and ATCs. As the workload of pilot increases the work of ATCs also increases. ATCs who perceived workload to be high reported more health complaints. Their moods were more negative and less positive (Repetti Rena, 1993). Grandjean and Wotzka (1971) study indicated that ATCs felt nervous, tense, irritated in difficult situation, were anxious and trembling, had increased perspiration, pulse rate and heart ache and suffered from insomnia and chronic fatigue. Urine sample of Air traffic controllers also indicated increase in Catecholamines after work as compared to subjects who performed normal office work.

Singer and Rutensranz (1971) reported that high dissatisfaction among ATCs is with respect to office administration, pay and working conditions.

However, results of these studies cannot be generalized to the Indian context since the working con-



ditions of ATCs in India are very different from those of advanced countries. There is also dearth of research on this professional group in India. A need was, therefore, felt to undertake research study on stressors, strain and coping strategies among Air Traffic Controllers working at the Mumbai airport.

### The Study

*Sample:* Data was collected from a sample of 40 air traffic controllers of Mumbai Airport. The age of the respondents ranged from 25 to 54 years, the mean age being 34.33 years. The years of experience ranged from 1 to 31 years, the mean experience being 9.38 years. The number of married ATCs was 35 (87.5 per cent) while the single ATCs was 5 (12.5 per cent).

*Instrument:* The instrument used for the study was a questionnaire consisting of a list of 14 stressors, strain and coping strategies. The respondent were asked to encircle the number on a five point scale ranging from '1 - Always' to '5 - Never' that best applies to them.

These factors were chosen on the basis of an interview and pilot study conducted on eight ATCs. The factors listed in the questionnaire were as follows:

#### Stressors:

1. Heavy traffic
2. Outdated equipment
3. Shift duties
4. Slow career development opportunities
5. Lack of housing/welfare facilities
6. Low monetary incentives
7. Division of authority among different bodies
8. Bird activity/Slums
9. Responsibility for people
10. Frequent VVIP and VIP movements
11. Lack of RT (Radio Telephony) discipline
12. Maintenance problems of equipments
13. Frequent transfers
14. Acute shortage of staff - work overload.

#### Strains:

1. Anxiety

2. Nervousness
3. Sleep disturbance
4. Continuous tension
5. Dissatisfaction with job
6. Circadian rhythm disturbed
7. Health problem (Blood pressure, Ulcer, acidity, digestive problem, heart problem)
8. Depression
9. Alienation from others
10. Smoking
11. Alcoholism
12. Fatigue
13. High consumption of caffeinated drinks
14. Use of sleeping pills

#### Coping Strategies:

1. Relaxation techniques
2. Counselling or speaking out with somebody
3. Analysing the situation logically
4. Taking a vacation
5. Physical exercise
6. Developing positive attitude
7. Yoga
8. Watching television
9. Planning and Goal setting
10. Religious activities
11. Time management
12. Workshop attendance
13. Seeking social support
14. Avoiding/Ignoring

#### Procedure

Prior permission for conducting the study was taken from the organisation. Respondents were approached individually and presented a questionnaire. They were asked to follow the instructions specified and return the questionnaire duly filled. Any doubts were clarified whenever they arose. A check was made to see that all items had been completed. The respondents were debriefed and thanked for their cooperation.

**Table 1: Stressors: Frequencies and Percentages**

Stressors	Frequency					Percentages					X <sup>2</sup>
	A	O	S	R	N	A	O	S	R	N	
1. Heavy Traffic	6	17	11	4	2	15	42.50	27.50	10	5	18.25**
2. Outdated Equipments	10	17	7	6	0	25	42.50	17.50	15	0	7.40
3. Shift/Night Duties	12	12	9	4	3	30	30	22.50	10	7.50	9.25
4. Slow Career Development	12	6	13	4	5	30	15	32.50	10	12.57	8.75
5. Lack of Housing/Welfare Facilities	21	12	6	1	0	52.50	30	15	2.50	0	22.20***
6. Low Monetary Incentives	15	11	10	3	1	37.50	27.50	25	7.50	2.50	17.00**
7. Division of Authority Among Different People	3	10	17	8	2	7.50	25	42.50	20	5	18.25**
8. Bird Activity/Slums	7	8	10	13	2	17.50	20	25	32.50	5	8.25
9. Responsibility for People	12	9	12	4	3	30	22.50	30	10	7.50	9.25
10. Frequent VVIP and VIP Movements	4	11	10	9	6	10	27.50	25	22.50	15	4.25
11. Lack of RT Discipline	2	8	6	20	1	5	20	15	50	10	31.24***
12. Maintenance Problems of Equipments	13	21	5	1	0	32.50	52.50	12.50	2.55	0	23.60***
13. Frequent Transfers	12	12	8	6	2	30	30	20	15	5	9.0
14. Acute Shortage or Staff Work Overload	7	11	16	5	1	17.50	27.50	40	12.50	2.50	16.5**

N = 40

\* P &lt; 0.001    \*\* P &lt; 0.01    \*\*\* P &lt; 0.05

### Data Analysis and Results

The data was analysed by using percentages and one way Chi square technique. Results show that the salient stressors that have been significantly experienced by ATCs are Heavy traffic, lack of housing and welfare facilities, low monetary incentives, division of authority among different people, lack of RT discipline, maintenance problems of equipment and acute shortage or staff work overloads.

The strain syndrome experienced by ATCs include anxiety, nervousness, continuous tension, Circadian rhythm disturbed, health problems (Blood pressure, ulcer, acidity, digestive problem, heart problems), depression, alienation from others, smoking, alcoholism, fatigue and use of sleeping pills.

The coping strategies used by ATCs include: relaxation techniques, counselling, or speaking out with somebody, analysing the situation logically, taking a vacation, physical exercise, developing a positive attitude, yoga, television or some other entertainment, workshop attendance and seeking social support.

### Discussion

The present study was designed to identify the most frequently experienced stressors, strain and coping strategies used by ATCs of Mumbai airport.

The results show that there are a number of stressors experienced by ATCs (refer table 1). Heavy traffic is an important stressor for ATCs especially in the Indian context, since the number of aircrafts per ATC are much more than in the west. This calls for greater alertness and speed and may result in higher amounts of stress.

ATCs in India perform their duties using outdated equipment or lack of modern navigational aids and sophisticated computers and other facilities which are easily available to western counterparts. This becomes a major source of stress for those who perform their duties in a highly reliable environment, demanding consistent and predictable performance.

Another major stressor was lack of housing and welfare facilities for ATCs. There are many officers who stay in houses meant for class IV employees due to shortage of enough accommodation. The lease granted

**Table 2: Strains: Frequencies and Percentages**

Strains	Frequency					Percentages					X <sup>2</sup>
	A	O	S	R	N	A	O	S	R	N	
1. Anxiety	4	7	18	9	2	10	17.50	45	22.50	5	19.25***
2. Nervousness	0	4	7	16	12	8	0.10	40	30	20	8.00*
3. Sleep Disturbance	13	7	9	8	3	32.50	17.50	22.50	20	7.50	6.50
4. Continuous Tension	1	13	8	11	7	2.50	32.50	20	27.50	17.50	10.50*
5. Dissatisfaction with Job	2	7	9	11	11	5	17.50	22.50	27.50	27.50	7.00
6. Circadian Rhythm Disturbed	9	9	15	6	1	22.50	22.50	37.50	15	2.50	13.01*
7. Health Problems (B.P. Vicer Acidity Digestive Problems Heart Problems)	2	4	17	10	7	5	10	42.50	25	17.50	17.25**
8. Depression	0	4	12	16	8	0	10	30	40	20	8.0*
9. Alienation from Others	2	5	21	6	6	5	12.50	52.50	15	15	27.75***
10. Smoking	3	4	7	5	21	7.50	7.50	17.50	12.50	52.50	27.50**
11. Alcoholism	1	2	4	11	22	2.50	5	10	27.50	55	38.25***
12. Fatigue	1	2	4	11	22	2.50	22.50	40	22.50	12.50	15.50**
13. High Consumption of Caffeinated Drinks	0	8	10	10	12	0	20	25	25	30	0.80
14. Use of Sleeping Pills	0	0	1	3	36	0	0	2.50	7.50	90	57.95***

N = 40

\* P < 0.001    \*\* P < 0.01    \*\*\* P < 0.05

**Table 3: Coping Strategies: Frequencies and Percentages**

Coping Strategies	Frequency					Percentages					X <sup>2</sup>
	A	O	S	R	N	A	O	S	R	N	
1. Relaxation Techniques	4	11	16	5	4	10	27.5	40	12.50	10	14.25**
2. Counselling or Speaking out with Somebody	3	11	14	10	2	7.5	27.5	35	25	5	13.75**
3. Analysing the Situation Logically	13	18	7	1	1	32.5	45	17.5	2.5	2.5	28.00***
4. Taking a Vacation	1	4	20	11	4	2.5	10	5	27.5	10	29.25***
5. Physical Exercise	6	6	17	6	5	15	15	42.5	15	12.5	12.75*
6. Developing a Positive	13	15	10	2	0	32.5	37.5	25	5	0	9.80*
7. Yoga	3	4	2	6	25	7.5	10	5	15	62.5	46.25***
8. T.V. or Some Orther	11	11	13	3	2	27.5	27.5	32.5	7.5	5	13.00*
9. Planning and Goal Setting	6	8	19	4	3	15	20	47.5	10	7.5	20.75***
10. Religious Activities	5	8	12	9	6	12.5	20	30	22.5	15	3.75
11. Time Management	4	14	12	7	3	10	35	30	17.5	7.5	11.75*
12. Workshop Attendance	1	3	7	15	14	2.50	7.5	17.5	37.5	35	20.0***
13. Seeking Social Support	3	0	13	15	9	7.5	0	32.5	37.5	22.5	8.40*
14. Avoidance/Ignoring	2	6	13	10	9	5	15	32.5	25	22.5	8.75

N = 40

\* P < 0.001    \*\* P < 0.01    \*\*\* P < 0.05

to the ATCs is not sufficient to hire a flat in Mumbai and hence they are forced to hire a flat in distant suburbs. This increases the stress for the ATCs as they are required to travel long distance to reach on the job. The colony provided for the ATCs lack welfare facilities like gymnasium or club where they can relax.

Another important stressor for ATCs was low monetary incentives. There is a great dissatisfaction with pay, because they compare themselves with pilots. Besides this, the ATCs get very less pay compared to their western counterparts. ATC's are not issued a license which also reduced their working opportunities in foreign countries.

Division of authority among different government bodies was another major stressor. In India the duties, responsibilities functions and authority is divided into many different bodies like Airport Authority of India (AAI), Airport police etc. Coordination and execution of duties and responsibilities between different government bodies may sometimes cause problems.

Another stressor was maintenance problems of equipment. The entire ATC system depends on various technical equipment. Failure of any of these systems can cause disaster. The maintenance of the equipment in India is not up to the standard. There are incidents where radar and navigational aids are not functioning from last many days and sometimes for months, thus causing stress.

Acute shortage of staff or work overload was also a major stressor. Other possible stressors less experienced by at least some of the respondents are shift duties, slow career development, bird activity/slums in airport vicinity, responsibility for others, frequent VVIP and VIP movements and frequent transfers. However these were not statistically significant.

A stressor can cause strain which may lead to certain physiological or behavioural changes. As documented in Table 2 some of the strains experienced were anxiety, nervousness, continuous tension, circadian rhythm disturbance, health problems, depression, alienation from others, fatigue, smoking, alcoholism and use of sleeping pills.

Other possible strains that were examined in this study but did not appear as significant for the present sample were sleep disturbance, dissatisfaction with job and high consumption of caffeinated drinks. Though these strains were felt by at least some of the respondents, the number of respondents strongly endorsing these strains was not statistically significant.

The coping strategies used by ATCs are several, yet it is expected that depending on the preference one or more coping strategies are used by the respondents. It is rather difficult to make out from the results (refer table 3) what are the coping strategies that are applied in combination. In a general sense, results show that the most frequently used coping strategies by ATCs are relaxation techniques, counselling or speaking out with somebody, analysing the situation logically, developing positive attitude, watching television, planning and goal setting, religious activities and time management.

In view of the analysis of stressors used in relation to coping strategies applied by the ATCs the result of the present study has implication for aviation industry. The list of stressors experienced by ATCs must be either reduced or eliminated for the safe flight operation. With the changing aviation scenario of 90's the ATC's stress and strain have increased to a great extent. These stress and strains can be coped up with the help of proper training of ATC's as to how some of the coping strategies can be used at workplace. If these techniques are practised immediate gain is possible in the form of reduced number of accident, greater enjoyment on the job, less experienced tension etc. In a broader sense the findings outlined above offer some insights into the experiences of professional group that has been rarely studied in the Indian context.

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# JIT Purchasing in India: Problems, Prospects and Directions

Dixit Garg, S.G. Deshmukh and D.K. Banwet

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*It is imperative for the Indian industries to become competitive for their survival in the emerging market scenario. Just-in-Time (JIT) based system is one manufacturing strategy to achieve competitiveness by eliminating all kinds of waste. JIT purchasing is one of its elements with significant potential for quality improvement, cost saving, and can be implemented in most of the industries. This paper discusses the prospects and implementation aspects including problems encountered and suitable recommendations to overcome them. Results of some studies conducted in Indian context have been highlighted. Some research directions are also identified.*

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## Introduction

With the development of faster means of communication such as fax, electronic mail, superior computers and rapid transportation systems, competition has become global in character. As a manufacturing company has to become competitive for its survival, it has to supply products of consistently high quality at reliable and reduced delivery time. Market also demands more product variations which means reduced lot size and high flexibility in operations. Manpower cost has also risen. All these factors tend to increase the product cost. But the industry has to maintain the cost at a reasonable level. It may be extremely difficult for developing countries like India to implement Advanced Manufacturing Technology (AMT) because of limited availability of resources. These countries need techniques which are characterized by low investment. Shorter pay-back periods, high productivity and quality. The Indian industry has to develop an efficient management system by which the cost in all areas of material, labour and overhead can be reduced and waste of all kinds eliminated. The Just-in-Time (JIT) based approach is one such approach to achieve the above stated goals.

JIT may be described as an extension of the original concept of managing the material flow in a factory to reduce the inventory levels (Schniederjans, 1993). It is an approach which is demand-driven and encourages flow type production. It is also described as a drive to simplify the manufacturing system in

**JIT may be described as an extension of the original concept of managing the material flow in a factory to reduce the inventory levels**

order to quickly detect the problems and force immediate solutions. JIT has been redefined and updated continuously by many researchers. It can be summarized as a system to eliminate waste and achieve excellence in an entire organisation.

Anything that does not add any value to the product is termed as waste. Waste may also be described as anything that is not necessary for the manufacturing of a product or is in excess. JIT aims to eliminate this type of waste.

### JIT Purchasing

The term 'purchasing' (Ansari and Modarress, 1990) simply describes the process of buying. However, in a broad sense, the term involves a broad range of activities such as determining the need, selecting the supplier, arriving at a proper price etc. The image and status of purchasing is driven by the contribution of the purchasing function to overall corporate performance and to the performance of other functions. There are strategic 'levers' (Carter and Narasimhan, 1996) that purchasing can use to enhance the chances for firm success. The strategic 'levers' include human resources management, active interaction with suppliers, influence over suppliers and interaction with other departments. Apart from this, presently one may find companies (Romero, 1991) where the cost of materials purchased exceeds the value added by production inside. It is clear from such situations that supply management has an important role in any cost reduction programme. The role becomes even more important if following facts are considered:

- low degree of technology required in this area,
- relatively small investment required as compared to other areas, and
- instantly obtained benefits which are maintained for a long term.

**The term 'purchasing' simply describes the process of buying. It involves a broad range of activities such as determining the need, selecting the supplier, arriving at a proper price etc.**

In view of the increased importance of purchasing function, the scope for JIT purchasing is growing rapidly.

Grieco *et al*, (1988) have defined 'JIT Purchasing' as the "Uninterrupted flow of 100 per cent acceptable materials delivered on due dates, at optimal cost, 100 per cent of the time". According to Gupta and Kini (1995), JIT purchasing is a "set of techniques and concepts for eliminating waste and inefficiency in the purchasing process". In JIT purchasing environment, purchasing is carried out in small lots with frequent deliveries in small standard containers used to hold exact quantity and to the required specifications from a nearly single local supplier with a long term contract. The company relies more on performance specifications than on product design. Supplier is evaluated by consistency in quality and delivery performance under different operating conditions, and the price. Consistent quality and delivery performance are the most important parameters in the supplier evaluation while price too is an important one. This process includes suppliers' management, inspection of incoming raw materials/semifinished/maintenance components, transportation system employed in buying activities etc.

**Consistent quality and delivery performance are the most important parameters in the supplier evaluation while price too is an important one.**

### Implementation

To implement JIT purchasing, a partnership between the supplier and buyer must be established through a multi-phased process that will embrace JIT purchasing characteristics. The following four phase implementation strategy may be suggested (Ansari and Modarress, 1990; Grieco *et al*, 1998; Schniederjans, 1993):

- Commitment of top management
- Learning process
- Pilot programme, and
- Implementation.

Top management seeking to implement JIT purchasing must make a conscious goal to establish JIT purchasing as a top priority. If top management can gain a commitment from employees, the change towards a JIT system is made easier. Learning process involves experimenting with JIT purchasing and trying to achieve incremental improvements by reducing inventories, eliminating waste, exposing problems, and responding immediately to them. It is not possible to

implement JIT purchasing overnight. In the beginning, some activities may be chosen from where the process of JIT implementation can be started. This process of beginning of JIT purchasing implementation can be termed as *pilot programme* (Ansari and Modarress, 1990). Starting the *pilot programme* with a few local suppliers and a few parts increases the likelihood of success because problems such as poor supplier quality can be measured based on which early deliveries can be monitored or adjusted. Success of a pilot programme depends upon a group effort among managers in several departments who share the same goals. If members of the group have conflicting goals, their disagreement will influence the action of certain departments. JIT purchasing must be designed to meet the needs of individual company. However, some common factors that are critical to its successful implementation are identified by many companies. They include the three phase process described as:

- changing the system
- selection of suppliers, and
- building relationships as per requirements of JIT purchasing.

#### Problems in JIT Purchasing Implementation

While JIT purchasing can provide impressive benefits in all areas such as quality, cost, human elements, productivity, purchasing, engineering etc., major problems can also arise. Their significance will depend upon a number of variables (Ansari, 1986; Ansari and Modarress, 1990; Grieco *et al*, 1988; Schonberger, 1982; Schonberger and Gilbert, 1983) like type of materials purchased, type of product manufactured, type of manufacturing processes and facilities utilized, product demand patterns, and the corporation's culture and organisational structure. The most serious problems, however, are not operational in nature. They are "people problems", stemming from attitude and orientation, past experience and practices, and the passive factors of interpersonal relations. The significant problems and appropriate recommendations as reported in the literature are presented in Table 1 (Ansari, 1986; Ansari and Modarress, 1990; Grieco *et al*,

While JIT purchasing can provide impressive benefits in all areas such as quality, cost, human elements, productivity, purchasing, engineering etc., major problems can also arise.

1988; Schonberger, 1982; Sloan and Weiss, 1987).

**Table 1:** Major Problems in the Implementation of JIT Purchasing

Major Problems	Recommendations
(a) Lack of support from suppliers	Education and training of suppliers in JIT purchasing. Development of a long-term mutual relationship with suppliers.
(b) Lack of top management support	Motivation of top management through learning and actual analysis of results
(c) Low product quality	Establishment of a quality management programme aimed at early identification of critical characteristics during design, manufacturing, and engineering stages of supply process.
(d) Lack of employee readiness and support	Establish on continuous long-term training of employees in JIT purchasing. Education of employees about company's main objective and the philosophy behind implementation.
(e) Lack of support from carrier companies	Drastic reduction in the number of carrier companies. Requirement of transportation services on a contract basis.
(f) Lack of engineering support	Constant co-ordination and co-operation among engineering, purchasing, and production departments.
(g) Lack of communication	Early involvement and high level of integration among purchasing, production, engineering, and transportation

#### Some Studies in Indian Context

The delphi study carried out by Prem Vrat *et al*, (1993) indicated the JIT index to be 23.38 on a 40 point scale (0-40), implying that though difficult, JIT implementation in India is quite possible. The study indicated that attention must be focussed on 100 per cent quality of incoming materials, and delivery by vendor on exact quantity at the exact time to achieve the results. Worker motivation and literacy need to be increased.

Garg *et al*, (1994) have discussed some vital issues in JIT purchasing in Indian context on the basis of a questionnaire sent to 80 different Indian industries. The issues include importance of JIT attributes, problems in implementing JIT, and expected benefits by JIT purchasing implementation. Some research portfolios are also identified for future research. Garg *et al* (1996b) extended their previous work (Garg, 1994) by applying statistical tests (chi-square and t-tests) to the data obtained from

questionnaire responses. Analysis of the survey indicates that there is general resistance to change and to adopt innovations, and co-operation of middle management is not found. The survey results indicate that:

- Professionals of automobile, heavy machines, and reputed industries have similar views about scope for JIT implementation in India.
- Companies of high, medium and low turnover do not have similar views about scope of JIT implementation in India. However, the opinions of high and low turnover executives are not statistically different.
- Companies having different layouts based on product, process or mixed have similar views about the scope for JIT implementation in India.
- Number of employees does not seem to have effect on scope for JIT implementation.

Purchasing has been identified as a JIT element with significant potential for quality improvement and cost saving and one which can be implemented in most of the industries.

The following problems are visualized:

- The suppliers and the employees are not trained about JIT purchasing.
- Transportation system is not reliable and consequently, deliveries are not received timely.
- Purchasing personnel often face problems about availability of accurate data, enough time for innovations etc.

In general, there is an indication that the Indian industries are giving 'good' importance to JIT attributes, although they may face some problems in implementing JIT purchasing. An overall 59.8 per cent benefits are expected if JIT purchasing is fully implemented.

Stamm and Golhar (1993) identified 34 and 15 attributes pertaining to JIT purchasing and supplier evaluation criteria respectively by reviewing 56 referred relevant articles. Garg *et al* (1997a) conducted a case study of an Indian automobile industry which has implemented JIT purchasing. It has been found that most of the identified JIT purchasing and supplier evaluation criteria attributes are being given 'very good'/'good' weightage. Suppliers programme of the company is also found to be giving good results. The company has sustained its competitiveness inspite of using old machinery by applying Japanese management techniques and JIT purchasing has a significant contribution in it.

Garg *et al* (1997b) has conducted a survey of Indian industries to find out importance of these identified attributes in the Indian context. The survey results indicate that attributes such as high quality, mutual trust and co-operative relationship, reliable (on-time) deliveries, delivery of exact quantity, increased customer (buyer) support to supplier, supplier evaluation, stable production schedule, reliable network of suppliers, reduced delivery lead time, quality circle, long term contract, continuous improvement, fewer suppliers, increased volume to supplier are being given high degree importance by surveyed companies. Supplier involvement in design, joint value analysis programme, supplier plant audit, and supplier training and development are being given less importance. In general, Indian companies are giving fairly good importance to JIT purchasing attributes. The outcome attributes are given more importance as compared to other groups by these industries. Among supplier evaluation criteria attributes following are found to be important: quality, reliable delivery, co-operative relationships, exact quantity, technical expertise, price, communication, financial stability (health) of supplier, and frequent delivery. Proximity, flexibility, and statistical process control are found to be given less important.

Garg *et al* (1996a) have analyzed 2 inventory models (Ramasesh, 1990; Baker *et al*, 1994) under JIT purchasing agreements and carried out their parametric analysis. It has been revealed that the long term contracts are beneficial but the risk and uncertainties involved with consequential losses should not be ignored. They have also proposed a logistic-based inventory model (1996c) for JIT procurement considering investments in vendor development and order processing, transportation, receiving and handling, and quality assurance subsystems. A parametric analysis has also been carried out to provide useful insights to help the management in decision making about level of investment in the various subsystems. The model has revealed that the total annual inventory cost is increased marginally with increase in (a) unamortized total investment at the beginning of the assumed period, (b) interest rate, (c) ordering cost, (d) service level, and (e) investment in the vendor development and order processing subsystem. One must proceed with investments in transportation, receiving and handling, and quality assurance systems, as these are capable of giving convincing returns.

## Conclusions

Successful implementation of JIT purchasing is the need of the hour in view of increased competition. Though, there are some existing problems in Indian



Though, there are some existing problems in Indian environment, most of the identified JIT purchasing and supplier evaluation criteria attributes are being given good importance by Indian industry.

environment, most of the identified JIT purchasing and supplier evaluation criteria attributes are being given good importance by Indian industry. Therefore, a lot of scope for JIT purchasing implementation in Indian context exists. The needs are to sort out identified problems in consultation with user groups, ingraining JIT in work culture and Indianization of JIT purchasing system. In general, it can be concluded here that the Indian industries must seriously consider and try to adopt JIT purchasing, may be in a phased manner. Implementing JIT purchasing will help the industries in achieving global competitiveness.

Some useful directions for future research are:

- Micro case studies of industries of different types and sizes like small, medium, large scale etc. must be carried out in the light of JIT purchasing implementation.
- Importance of various attributes may be determined in different types of industries to have cross cultural experiences of developing and developed countries at micro level.
- There is a need for providing a framework for performance assessment taking into account cost-benefit analysis of implementing JIT purchasing.
- Research is required (a) to investigate whether inventory has indeed to be removed from the supply chain or simply redistributed to other, upstream members of chain, and (b) to assess the benefits of entering into JIT programme and factors affecting these benefits relevant to a supplier.
- Expertise of single supplier for many parts may need close scrutiny.

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# Single Model Deterministic Assembly Line Balancing: A Case Study

S. Narayanan and R. Panneerselvam

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*Among various techniques available to achieve the productivity, Assembly Line Balancing (ALB) is a dominant technique to improve the productivity in the area of mass production. Basically ALB assigns work elements to a number of work stations without violating precedence relationships so that the balancing efficiency of the assembly line is maximized for a given volume of output. In this paper, apart from a comprehensive review of single model deterministic ALB literature, an existing algorithm has been modified with cost consideration and it has been applied to a realistic situation manufacturing mixes.*

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## Introduction

In mass production, it is essential to design assembly line in a better way by taking to production volume per shift and the effective time available per shift as inputs. Assembly line is the best example of product layout used in mass production which consists of a number of work elements (tasks). A detailed specification of how the assembly of product flows from one element to another element(s) is usually indicated by precedence relationship. These work elements are usually divided into a set of workstations such that the balancing efficiency is maximized. While forming the work stations, care should be taken such that the sum of the processing times of the assigned work elements in each station is not more than the cycle time and also all the immediate predecessors of the work elements which are assigned to that station are already assigned to some other earlier station(s)/that station (current station) or they don't have any predecessor(s). The cycle time is computed based on the production volume per shift and the effective time available per shift.

The methodologies available to solve ALB problems can be classified into exact methods and heuristic methods which are as given below.

## Exact Methods

- Linear Programming
- Integer Programming
- Dynamic Programming
- Goal Programming
- Shortest Path Technique
- Maximal-Path Technique
- Branch and Bound Technique

## Heuristic Methods

- Priority Ranking Methods
- Tree Search
- Trade Transfer
- Random Sampling

## Classification of ALB Literature

The ALB problems and literature can be classified into four categories (Fig. 1) as below:

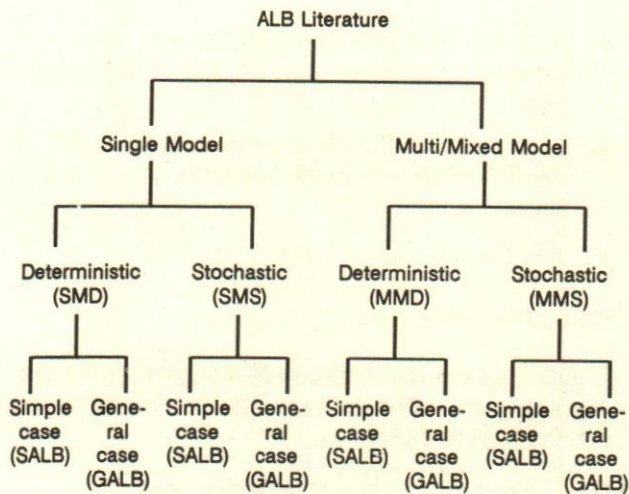


Fig. 1. Classification of ALB Literature

In SMD problems, task times are known deterministically. In SMS problems, the task times are not deterministic. They follow a probability distribution.

In MMD problems, the task times are deterministic in nature but multiple products are assembled. Multi-model means two or more products are assembled separately in batches. Mixed-models indicate assembling single product of different models (sizes). But both are considered under the same category.

### Single Model Deterministic Assembly Line Balancing Problem (SMD)

Salveson (1955) formulated SMD problem as a linear programming problem, leading to the difficulty of split task in the optimal solution. The difficulty was removed (Bowman 1960) by formulating ALB as an integer programming problem assigning tasks to stations with 0-1 variables. It was later modified (White 1961). Klein (1963), Thangavelu and Shetty (1971), Patterson

and Albracht (1975) and Talbot and Patterson (1984) formulated the ALB as a general integer programming problem without binary variables. Jackson (1956), Hu (1961), Van Assche and Herroelen (1979), Johnson (1981) and Wee and Magazine (1981) used branch and bound technique to solve ALB problems. A number of line balances using priority rules based on sampling have been generated by COMSOAL (Arcus, 1966). Again computerised Assembly Line Balancing (CALB) concerns about task groupings, task-to-station assignments along with variable labour wage rates. Generally computational comparisons between these optimal methods are difficult.

Optimal solution techniques have been reported in SALB version of SMD problems. Because of the need to solve large scale and real world problems of General Assembly Line Balancing (GALB) and also of non-existence of highly efficient optimal approaches, heuristic techniques have been adopted. Many heuristic approaches use the priority ranking (or) tree search techniques.

A computer programme developed by Buxey (1974) incorporates multiple parallel stations, spatial zoning and complementary tasks. Another programme called NULISP, has been developed by Nottingham University in England, (Schofield, 1979), also allows variable inspection times, but does not allow stochasticity. The solution to this type of ALB problem is very much sensitive to several parameters, consequently a set of 10 priority rules have been devised (Dar-EI, 1975).

Later, Panneerselvam *et al.* (1993) have improved Dar-EI's work and came out with an efficient set of 9 priority rules. This set consists of 3 priority rules from Dar-EI's work and 6 new priority rules proposed by Panneerselvam *et al.*

Since, the solution of assembly line balancing is very much affected by several factors, it is highly essential to solve the problem using a set of priority rules which will take care off the effects of all the factors, like Panneerselvam *et al.*'s work. Since, it is an improved

Since the solution of assembly line balancing is very much affected by several factors, it is highly essential to solve the problem using a set of priority rules which will take care off the effects of all the factors.

version of Dar-El's work, one can use it to solve such problems.

But, the demand is always on the raising trend for most of the products. Hence, companies will be interested in designing their assembly line to the maximum production volume possible. Under such circumstances, one has to provide a ready-made solution for different volumes of production. This aspect has been discussed in the present paper. The cost consideration along with the usual data on precedence relationship, processing times, effective time per shift and production volume per shift would lead to meaningful and realistic solution.

In particular, fixed cost and the variable cost their total cost and total cost per unit for various volumes of production are computed. Then the production volume with the minimum total cost per unit is selected as the best solution for implementation, provided the corresponding production volume is more/near about the actual demand. If the actual demand is lesser than the optimal production volume as discussed above, then the line is to be designed for the actual demand.

**When the production volume is increased, the cycle time will decrease. At certain stage, the cycle time will become less than the time of certain work elements.**

When the production volume is increased, then the cycle time will decrease. At certain stage, the cycle time will become less than the time of certain work elements. Under such situation, generally two or more operators will be assigned to each of those work elements whose processing time is more than the cycle time such that its effective processing time is marginally less than the cycle time. In the present paper the Single Model Deterministic Assembly Line Balancing problem of a Mixie manufacturing company has been discussed.

### ALB Terminology

#### Work Station

It is an assigned location where a given amount of work is performed. Normally work stations are manned by one operator. However, under specific circumstance, an operator may man more than one station and sometimes workstations are frequently manned by several operators.

### Cycle Time (CT)

$$CT = \frac{\text{Effective time available per period}}{\text{Production volume per period}}$$

where

$$\text{Effective time available per period} = \frac{\text{(Time per period)}}{8} \text{ (percentage utilization of the period)}$$

The cycle time may be interpreted in the following ways.

- It is the time between consecutive release of finished assemblies from the last station of the line.
- It is the time between consecutive release of semi-finished products between any two stations.
- It is the total time allocated per station.

### Balancing Efficiency

It indicates the percentage utilization of all the stations put together. The formula for the balancing efficiency is as given below.

$$\text{Balancing Efficiency} = \left[ \frac{\text{SACT}}{\text{N} \times \text{CT}} \right] \times 100$$

where SACT – the sum of the assigned cycle time.

N – Number of stations.

### Case Study

The assembly line for manufacturing Mixies comes under Single Model Deterministic Assembly Line Balancing Problem. The precedence diagram of the assembly line is shown in Fig. 2. The details of the work elements, their processing times are shown in Table 1.

The demand for mixies is growing steadily. So, the company is interested in having a ready-made solution (Assembly line balancing solution) for different volumes so that it can cope up with the demand in future. The production volume of the assembly line can be increased by using any one of the following options:

- (i) Increasing the number of shifts and (ii) increasing the production volume per shift. The company is keen in implementing the second option. The cost data pertaining to this option are as follows:

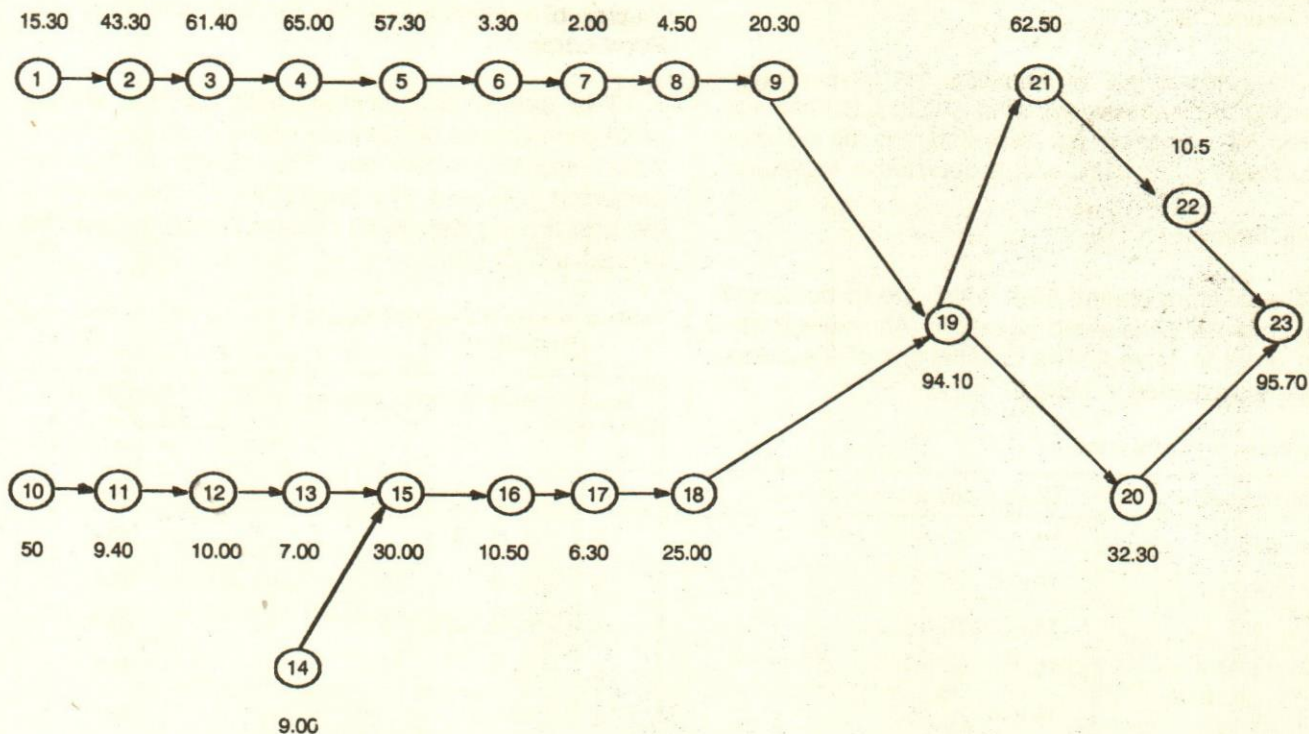


Fig. 2. Precedence Diagram

Fixed cost per day (For Maximum capacity of 350 units) = Rs. 40000

Variable cost per unit = Rs. 1100

(Variable cost includes labour cost, material cost and overhead cost).

In order to have a 25 per cent increase in the output, an additional 25 per cent of the fixed cost is to be invested. That is Rs. 10,000. So, it is desirable to identify the production volume at which the total cost per unit is minimum (Total cost = Fixed cost + Variable cost). This is feasible if we have sufficient demand.

### Objectives

The objectives of this case study are:

- To design the assembly line for the current volume of production.
- To identify the optimal production volume at which the total cost per unit is minimum.

Then to design the assembly line at the optimal production volume.

Table 1: Details of Processing Work Elements

Operation Number	Description of the Operation	Standard Time (Sec)
01	Fixing motor on to the adapter	15.30
02	Fixing the Base	43.30
03	Chord connections and wire dressing	61.40
04	Mechanical testing	65.00
05	Electrical testing	57.30
06	Fixing tunnel	03.30
07	Fixing motor support	02.00
08	Relay connections	04.50
09	Inverting bottom plates & screw tightening	20.30
10	Drilling and reaming	17.50
11	Pressing the brass bush to cup	09.40
12	Applying the bond	10.00
13	Fixing the circular ring	07.00
14	Jar correction	09.00
15	Rivet preparing	30.00
16	Riveting	10.50
17	Handle Assembly	06.30
18	Blade Assembly	25.00
19	Overall testing	94.10
20	Cleaning and buffing	32.30
21	Dome packing	62.30
22	Thermocoal packing	10.50
23	Overall packing	95.70

## ALB Heuristics

The efficient set of heuristics for assembly line balancing (Panneerselvam, *et al.*, (1993) has been considered for designing the assembly line of the mixie manufacturing company, and, is depicted in Annexure I.

### Priority Rules

The different priority rules which are to be used in step 11 of the generalized algorithm (Annexure I) have been given in Table 2. The descriptions of the priority rules are presented in Table 3.

**Table 2:** List of Priority Rules

Heuristic Number	Combination of Priority Rules
1	TF
2	TF+LC
3	TF+LC+TL
4	TL
5	TL+LC
6	TL+IF
7	TL+TF
8	RPW
9	TNF

**Table 3:** Description of Priority Rules

- (a) **Ranked Positional Weight (RPW):**  
The positional weight of a work element is its own processing time added to those of all following work elements. This selects the work element with the highest RPW.
- (b) **Total number of jobs Following (TF):**  
This is the sum of all work elements that follow the work element under consideration. This selects the work element which has the maximum number of jobs following.
- (c) **Largest Candidate rule (LC):**  
This selects the candidate work element having the largest processing time.
- (d) **Total number of Immediate Followers (IF):**  
This selects the work element having the largest number of immediate followers.
- (e) **Total number of Levels (TL):**  
This selects the work element having the maximum number of levels on which its followers are positioned.
- (f) **Total number of unassigned jobs, Not Following:**  
This is the difference between the total number of unassigned work elements (TUWE) and the total number of jobs following (TF i.e. TUWE-TF). This selects the work element having the minimum number of unassigned jobs not following.

## Design of Assembly Line for Existing Volume of Production

This design is concerned with for the existing production volume of 300 units with a cycle time,  $CT = 28800 \text{ sec}/300 = 96 \text{ sec}$ . The results of ALB are presented in Table 4. The results given in the Table 4 is the best among the results obtained using the set of 9 heuristics (Table 2).

**Table 4:** Results of Design of Assembly Line for Existing Volume of Production

Station Number	Work Elements Assigned	Sum of the Assigned Cycle Time (SACT) (Sec.)
1	1, 2, 10, 11, 12	95.5
2	3, 14, 13	77.4
3	4, 15	95.0
4	5, 16, 17, 6, 7, 8	83.9
5	18, 9	45.3
6	19	94.1
7	21, 20	94.8
8	22	10.5
9	23	95.7

$$\text{Cycle time (CT)} = 96 \text{ secs.}$$

$$\text{No. of stations (N)} = 9$$

$$\text{Balancing Efficiency} = \frac{[\text{SACT of all Stations}/\text{CT} \times \text{N}]}{100} = 80.11\%$$

## Design of Assembly Line for the Optimal Volume of Production

The variation of the sum of the fixed cost and variable cost and also the total cost per unit with respect to different volumes of production is presented in Table 5. The management is interested in increasing the production volume up to 25 per cent of the present capacity of 350 units/day if there is sufficient demand in future. So, authors made an attempt to compute the total cost per unit for every 25 units increase in the production volume from the present production volume of 300 units per day up to 437 units per day which is 125 per cent of the present capacity.

From the above table, it is clear that the total cost per unit of production is minimum when the production volume is 350 units per day. But, the next nearest minimum total cost per unit of production is for the production volume of 437 units per day. But the difference between these two costs is very very

insignificant. So, the desirable volume of production is 437 units per day.

**Table 5:** Determination of Desirable Production Volume

S.No.	No. of units per day	fixed cost per day (Rs)	variable cost per day (Rs)	total cost per day (Rs)	cost per unit (Rs)
1.	250	40,000	2,75,000	3,15,000	1260.00
2.	275	40,000	3,02,500	3,42,500	1245.45
3.	300	40,000	3,30,000	3,70,000	1233.33
4.	325	40,000	3,57,500	3,97,500	1223.07
5.	350	40,000	3,85,000	4,25,000	1214.28
6.	375	50,000	4,12,500	4,62,500	1233.33
7.	400	50,000	4,40,000	4,90,000	1225.00
8.	425	50,000	4,67,500	5,17,500	1217.65
9.	437	50,000	4,80,700	5,30,700	1214.42
10.	438	60,000	4,81,800	5,41,800	1236.98

Again, the set of 9 heuristics has been applied to the problem with the production volume of 437 units per day and the best results are summarized in table 6, for which:

Cycle time (CT) = 65.9 secs.  
 No. of stations (N) = 11  
 Balancing Efficiency =  $[\text{SACT of all stations}/(\text{CT} \times \text{N})] \times 100 = 82.39\%$

**Table 6:** Results of Design of Assembly Line for Desirable Volume of Production

Station Number	Work Elements Assigned	Sum of the Assigned Cycle Time (SACT) (Sec.)
1	1, 2	58.60
2	3	61.40
3	4	65.00
4	10, 11, 12, 14, 13	52.90
5	5, 6, 7	62.60
6	15, 16, 17, 8	51.30
7	18, 9	45.30
8	19	47.05
9	21	62.50
10	20, 22	42.80
11	23	47.85

### Design of Assembly Line for Other Volumes of Production

The best results of SMD Assembly Line Balancing using efficient set of heuristics of Pannervselvan, *et al.* for different volumes of production starting from 325 in steps of 25 upto 425 are shown in Tables 7 to 11, respectively.

**Table 7:** Results of Design of Assembly Line for 325 Units per day of Production Volume

Station Number	Work Elements Assigned	Sum of the Assigned Cycle Time (SACT) (Sec.)
1	1, 2, 10, 11	85.50
2	3, 12, 14, 13	87.40
3	4	65.00
4	5, 15	87.30
5	16, 17, 6, 7, 8, 18, 9	71.90
6	19, 20	79.35
7	21, 22	73.00
8	23	47.85

Volume of production = 325 units/day  
 C.T. =  $8 \times 60 \times 60 / 325 = 88.6 \text{ Sec.}$   
 No. of stations (N) = 8  
 Balancing Efficiency =  $[\text{SACT of all Stations}/(\text{CT} \times \text{N})] \times 100 = 84.27\%$

**Table 8:** Results of Design of Assembly Line for 350 Units per day of Production Volume

Station Number	Work Elements Assigned	Sum of the Assigned Cycle Time (SACT) (Sec.)
1	1, 2, 10	76.10
2	3, 11, 12	80.80
3	4, 14, 13	81.00
4	5, 6, 7, 8	67.10
5	15, 16, 17, 18	71.80
6	9, 19	67.35
7	21, 22	73.00
8	20, 23	80.15

Volume of production = 350 units/day  
 C.T. =  $8 \times 60 \times 60 / 350 = 82.3 \text{ Sec.}$   
 No. of stations (N) = 8  
 Balancing Efficiency =  $[\text{SACT of all Stations}/(\text{CT} \times \text{N})] \times 100 = 90.72\%$

**Table 9: Results of Design of Assembly Line for 375 Units per day of Production Volume**

Station Number	Work Elements Assigned	Sum of the Assigned Cycle Time (SACT) (Sec.)
1	1, 2, 10	76.10
2	3, 11	70.80
3	4, 12	75.00
4	5, 14, 13, 6	76.60
5	15, 16, 17, 7, 8, 9	73.60
6	18, 19	72.05
7	21, 22	73.00
8	20	32.30
9	23	47.85

Volume of production = 375 units/day  
 C.T. =  $8 \times 60 \times 60 / 375 = 76.8$  Sec.  
 No. of stations (N) = 9  
 Balancing Efficiency =  $[\text{SACT of all Stations} / (\text{CT} \times \text{N})] \times 100 = 86.41\%$

**Table 10: Results of Design of Assembly Line for 400 Units per day of Production Volume**

Station Number	Work Elements Assigned	Sum of the Assigned Cycle Time (SACT) (Sec.)
1	1, 2, 14	67.60
2	3	61.40
3	4	65.00
4	10, 11, 12, 13	43.90
5	5, 6, 7, 8	67.10
6	15, 16, 17, 18	71.80
7	9, 19	67.35
8	21	62.50
9	20	22.00
10	23	47.85

Volume of production = 400 units/day  
 C.T. =  $8 \times 60 \times 60 / 400 = 72$  Sec.  
 No. of stations (N) = 10  
 Balancing Efficiency =  $[\text{SACT of all Stations} / (\text{CT} \times \text{N})] \times 100 = 82.96\%$

**Table 11: Results of Design of Assembly Line for 425 Units per day of Production Volume**

Station Number	Work Elements Assigned	Sum of the Assigned Cycle Time (SACT) (Sec.)
1	1, 2, 14	67.60
2	3	61.40
3	4	65.00
4	10, 11, 12, 13	43.90
5	5, 6, 7, 8	67.10
6	15, 16, 17, 9	67.10
7	18	25.00
8	19	47.05
9	21	62.50
10	20, 22	42.80
11	23	47.85

Volume of production = 425 units/day  
 C.T. =  $8 \times 60 \times 60 / 425 = 67.76$  Sec.  
 No. of stations (N) = 11  
 Balancing Efficiency =  $[\text{SACT of all Stations} / (\text{CT} \times \text{N})] \times 100 = 88.15\%$

**Summary of Results**

Table 12 gives the results (Number of work stations and balancing efficiency) at all the volumes of production. This table in conjunction with the results shown in the preceding tables can be used as a ready-made solution for any volume of production in future.

**Table 12: Summary of Results at all Volumes of production**

S.No.	Volume of Production	No. of work Stations	Balancing Efficiency %
1.	300	9	80.11
2.	325	8	84.27
3.	350	8	90.72
4.	375	9	86.41
5.	400	10	82.96
6.	425	11	88.15
7.	437	11	82.39



## Conclusions

In this article means for improving the productivity of the assembly line in a Mixie Manufacturing Unit using an efficient set of heuristics has been discussed. The work has been carried out in three phases.

- Finding the best solution for the current volume of production.
- Finding the best production volume and corresponding best solution.
- Finding the best solution at other volumes of production.

The best solution at the existing volume of production (300 units per day) has been implemented at present.

The other results can act as ready-made solution depending on the future volume production.

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## Generalized Algorithm

- Step 0: Input, cycle time (CT), precedence matrix, total number of work elements (M) work elements times.  
Initialize: Unassigned cycle time (UACT) = CT, Station number (SN) = 1 and total number of assigned work elements (N) = 1.
- Step 1: Print the station number (SN).
- Step 2: Initialize the Total number of work elements counter to one. i.e.,  $l = 1$ .
- Step 3: If the  $l$ -th work elements is already assigned, go to step-7; otherwise go to step 4.
- Step 4: If all the immediate predecessors of the  $l$ -th work element are assigned then go to step-5; otherwise go to step-7.
- Step 5: If the  $l$ -th work element time is less than or equal to the unassigned cycle time (UACT), then go to step-6; otherwise go to step-7.
- Step 6: Include this  $l$ -th work element in the list-A which consists of work elements whose all immediate predecessors are assigned and the processing time of each work element is less than the unassigned cycle time (UACT).
- Step 7: Increment the total number of work elements counter by one i.e.,  $l = l + 1$ .
- Step 8: If  $l < = M$ , then go to step-3; otherwise go to step-9.
- Step 9: If the number of work elements in the list-A is more than 0, then go to step 11; Otherwise go to step 10.
- Step 10: Perform the following and then go to step-2.  
(i) Add UACT to the sum of unassigned cycle time (SUACT).  
(ii) Update UACT = CT  
(iii) Update SN = SN + 1  
(iv) Print SN.
- Step 11: If the number of work elements in the list-A is equal to one then assign that work element to the current station; otherwise select a work element from list-A using a given HEURISTIC.
- Step 12: Subtract the recently assigned work element time from UACT and print the recently assigned work elements number.
- Step 13: Update  $N = N + 1$
- Step 14: If  $N < = M$ , then go to step-2; otherwise go step-15.
- Step 15: Compute the Balancing Efficiency in percentage (BE).  $BE = [(SACT \text{ of all Stations}) / (CT * N)] * 100$ .
- Step 16: Stop.

The primary class of problems that reengineering is structured to solve is operational. That is, you know what to do, but you are not doing it so well.

— Michael Hammer

# Empowerment: An Integrated Perspective

J. Venkatachalam

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*'Supervisors and Managers are going to have to be more willing to share power, to ask employees what needs to be done.'*

— Newman, C. (1991)

*As traditional means of managerial control of people in an organisation is increasingly becoming obsolete in today's industrial world, a need has arisen to improve upon organisation control. Instead, the new concept of managerial empowerment has been advanced to make the workforce to perform more and better. The present paper, emphasizes issues involved in the process of empowering employers and organisations as well. Besides reviewing the research in this field, it indicates, with special emphasis to Indian industry, as to how to build empowering culture and evolution of requisite leadership. The problems of implementing empowerment are also briefly touched upon.*

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## Introduction

The world is moving too fast for the old, traditional means of control. Customers are demanding more than ever as most options are available in the market. It is necessary to adapt to the changes caused due to technological advancements or create changes for growth and success.

Organisations are built by the aggregation of people and in order to achieve the organisational objectives, the people should behave in a manner specified by the organisational rules, regulations, policies and other methods. Organisations try to regulate the behaviour of their members through the process of control. Normally, a person controls the behavior of other persons through the process of influence which involves a series of social interactions.

**Organisations are built by the aggregation of people and in order to achieve the organisational objectives, the people should behave in a manner specified by the organisational rules, regulations, policies and other methods.**

Thus, the traditional management model of "the manager in control, and the employees being controlled and bureaucracy" does not work. Instead, top managers have to grab re-engineering and somehow use this fact to empower the work force to perform more and better. This is not an easy task of course.

In a bureaucratic organisation, power lies with the people who are at the top in the hierarchy. The leaders

**Power is the ability to influence people and events. It is the leader's stock in trade, the way that leaders extend their influence to others.**

at the top use their power on their subordinates. All leaders deal with power and politics as referred by Roberts (1986). Power is the ability to influence other people and events. It is the leader's stock in trade, the way that leaders extend their influence to others. It is somewhat different from authority, because authority is delegated by higher management.

Authority is another means of influencing and controlling the behavior of people in the organisation. The term authority is defined by Weber (1947) as the willing and unconditional compliance of people, resting upon their belief that is legitimate for superior to impose his will on them and illegitimate for them to refuse to obey.

The present article emphasizes the issues involved in the process of empowering employees and organisations as well, with focus on how researchers have defined empowerment, concern for empowerment in an organisation and how the empowerment has evolved in Indian philosophy. Further, the article deals with the need for empowerment, how to build empowering culture and leadership, to know the role and characteristics of a manager in an empowering work place and lastly, the characteristics and principles of empowerment.

Empowerment became a favourite buzzword among the leaders of various social movements during the 1960s and 1970s. Activists saw empowerment as a way for 'out' groups to gain control over their own destinies. The term empowerment in management literature appears to have come into general usage in the early 1980s (Hvpfl, 1994). By the mid 1980s it had become a commonplace expression used in both practical management texts and in the vocabulary of organisations.

### **Empowerment and Organisations**

Organisations drift in response to circumstances, in a system where it allows quick action but not just reaction. An organisation whose leaders exercise empowerment to deal with new situations build a stronger leadership infrastructure than does a system that relies on traditional hierarchical structures or bureaucracies. The demands made on employees in empowering or-

ganisations are broader than those in more traditional systems. However, considerable time and attention are necessary to prepare employees for their responsibilities (Kanter, 1983; Kieffer, 1984; Murrel, 1977).

**An organisation whose leaders exercise empowerment to deal with new situations build a stronger leadership infrastructure than does a system that relies on traditional hierarchical structures or bureaucracies.**

Empowerment is getting workers to do what needs to be done rather than doing what they are told (Daraugh, 1991). It involves delegation, individual responsibility, independent decision making and feelings of self confidence.

Empowerment is transfer and acceptance of power to the lowest appropriate level in order to create an opportunity for maximum individual initiativeness, responsibility and commitment which carries risks; herein the delegated person has to take responsibility for the results when fails (Hayward, 1995). Empowerment is a process of helping the right people at the right levels make the right decision for the right reasons (Holpp, 1995). Empowerment is an art of building, developing and increasing power through cooperating, sharing and working together (Rothstein, 1995). Empowerment is the art of giving employees an opportunity to commit to something that provides an opportunity for personal growth (Banner and Gagne, 1995).

**Empowerment is transfer and acceptance of power to the lowest appropriate level in order to create an opportunity for maximum individual initiativeness, responsibility and commitment which carries risks.**

### **Definition of Empowerment**

Conger and Kanungo (1988) defined empowerment as the motivational concept of self-efficacy. Thomas and Velthouse (1990) argued that empowerment is multifaceted and that its essence cannot be captured by a single concept. They defined empowerment more broadly as increased intrinsic task motivation manifested in a set of four cognitions reflecting an individual's orientation

to his or her work role: meaning, competence (which is synonymous with Conger and Kanungo's self-efficacy), self-determination and impact.

(i) *Meaning*: It is the value of work goal or purpose, judged in relation to an individual's own ideals or standards (Thomas & Velthouse, 1990). Meaning involves a fit between the requirements of a work role and beliefs, values and behaviours (Brief and Nord, 1990; Hackman and Oldham, 1980).

(ii) *Competence*: Competence or self efficacy, is an individual's belief in his or her capability to perform activities with skill (Gist, 1987). Competence is analogous to agency beliefs, personal mastery, or effort-performance expectancy (Bandura, 1989). Spreitzer (1995) labeled it competence rather than self-esteem because he focussed on efficacy specific to a work role rather than on global efficacy.

(iii) *Self-determination*: Where competence is a mastery of behavior, self determination is an individual's sense of having choice in initiating and regulating actions. (Deci, Connell and Ryan, 1989). Self determination reflects autonomy in the initiation and continuation of work behaviors and processes; examples are making decisions about work methods, pace and effort (Bell and Staw, 1989; Spector, 1986).

(iv) *Impact*: Impact is the degree to which an individual can influence strategic, administrative, or operating outcomes at work (Ashforth, 1989). Impact is the converse of learned helplessness (Martinko & Gardner, 1982). Further, impact is different from locus of control: where as impact is influenced by the work context, internal locus of control is a global personality characteristic that endures across situations (Wolfe and Robertshaw, 1982).

These four cognitions reflect an active rather than a passive orientation to a work role (Spreitzer, 1995). They specify a nearly complete or sufficient set of cognitions for understanding psychological empowerment (Thomas and Velthouse, 1990).

### **Empowerment: A Continuous Process**

Empowerment is a trust based process of assigning authority to make decisions within one's own area of operations without having to get approval from higher-ups. People are encouraged to use their initiative in the empowerment process. In the process of empowerment, people are allowed to use the authority and the resources available as well. Empowerment is a continuous process, which prevents sulking attitude and in-

creases one's own worth both in terms of personal and organisational perspective as long as they acquire encouragement and support from the higher-ups. The process of empowerment is claimed to involve enhancing feelings of self-efficacy among organisation's members through the identification of conditions that foster powerlessness. Through their removal by both formal organisational practices and informal techniques provide efficacy of information.

**Empowerment is a trust based process of assigning authority to make decisions within one's own area of operations without having to get approval from higher-ups.**

The objectives of the empowerment process are to generate positive feelings among people about themselves, to enable them to develop relationships with each other based on empathy and respect, to ensure their voluntary compliance with roles and structure and provide adequate resources to make full contribution, in their roles as managers.

Empowerment is the process transforming followers into effective self-leaders (Sims and Manz, 1996) and is a process of helping employees achieve job mastery, providing successful role models, using social reinforcement and persuasion, and giving emotional support (Newstrom and Davis, 1994).

### **Paths to Empowerment**

Empowerment is more of a state of mind, than a set of team behaviours or organisational policies. It can't exist unless individual attitudes and mindsets, team behaviours and organisational values all support it. Many attempts to create empowerment fail because they only create change at one of those said levels. Empowerment involves three major shifts i.e., toward process, toward responsibility and toward learning in the mindset for everyone in an organisation (Scott and Jaffe, 1991). The shifts from getting the job done to attending to process, taking responsibility for the development of whole organisation, and solving problems using active learning, is at the core of shift to empowerment.

### **Empowerment: A Growing Concern**

The globalization of market economies has resulted in a highly competitive dynamic market. Due to this,

there has been a growing concern for empowering everyone, from the top in the hierarchy down to the front-line workers in the organisations. All over the world, it has been realized that only those enterprises which liberate themselves by empowering their people can survive in this turbulent environment.

Employees have to decide and act accordingly in the real time. Immediate feedback is necessary for people who have done some mistakes and it should see the person not repeating the same mistake. This will be a learning experience for that person. Moreover, organisations are increasingly being designed according to holographic properties (Pasmore, 1994). Hence, it is necessary to empower the person at the point of contact and the customer or supplier to provide satisfaction when it means the most. Today's advanced information technology makes it possible for the organisations to empower their employees for which the culture of the organisation needs change.

### Empowerment in the Indian Philosophy

The concept of empowerment has its root in the 'Vedanta' and 'Bhagavad Gita'. The Vedanta asserts: *Tat tvamasi* (you are that): you are infinitely powerful. You have power within you. Likewise, The Bhagavad Gita (XVIII-46) specifies: '*Svakarma tam abhyacha siddhim vindata manava*' (Human being can attain the 'Sidhi' – the final accomplishment, by worshiping God by His work. Work becomes a means of self-expression. To articulate work as a means of self-expression, one has to understand that one's energy and happiness are within oneself. There is a need to merely realize that one has infinite energy but that this must be organised in a collective form. This can help him to actualize the inner potential. The Gita further specifies '*Yajnakarma*' implies collective work, dedicated to a higher purpose i.e., consumer satisfaction. This is also the underlying philosophy of the modern concept of empowerment (Dwivedi, 1995).

### Organisational Change

The change in organisations due to empowering culture is inevitable. Higher expectations of quality of life at work are increasing and transfer of services from public to private sectors is taking place. In tune with this, people should act with innovativeness, creativity, intelligence, and initiate ideas at each and every level. Further, it is also important to learn how to unite people in solving common problems and respecting and valuing personal differences. Organisations which do this will have the best chance of surviving and prospering. They will attract the most able people and have the best relationships with customers (Block, 1993; Harman and Harman, 1990).

Changing the culture of an organisation has become a popular aspiration among the top management. There is also a growing recognition of connection between the quality of life within organisations and delivery of quality and value to the customer needs. The behavior and attitudes of the people will pave the way in creating the culture of an organisation. Often, there may be a huge gap between the actual behavior of leaders and espoused culture, values and beliefs. In order to create empowering and unifying culture one needs to develop the following characteristics/attributes (Nixon, 1994):

- Develop an inspiring vision of the future – invite others to do likewise; Learn to love change and uncertainty.

There is a growing recognition of connection between the quality of life within organisations and delivery of quality and value to the customer needs.

- Decide to appreciate the whole situation and see that everything goes well – implies listening to a wide range of people.
- Become a leader of leaders, release intelligence and initiativeness.
- Create an environment of appreciation, high expectations and support.
- See yourself as a life-long apprentice; develop high self-esteem.
- Learn to listen with complete respect and ask empowering questions and teach others the new skill of empowerment.
- Put an end to complaining and blaming.
- Develop concrete plans and review them regularly (Simmons, 1993).

Figure 1 shows the stages of the need for employee empowerment, which are arranged horizontally with a view to achieving cross functional integration (Coleman Jr. 1996).

### Developing empowering attitude

The basic shift from traditional management thinking is the beginning to develop an empowering attitude. The value of trust and positive expectations on

**Trust is the outcome of a proper psychological contract between company and employee, when the exchange relationship of what one will give and get in return matches the organisation's expectations of fair exchange.**

employees are the most effective ways of motivating people. Trust begets trust: "The offering of trust must at first be unilateral on the part of management. Trust worthiness, tomorrow, comes only after granting trust in the first place—today" (Peters, 1992, p. 463). "Without trust one cannot expect the human imagination to pursue value-added" (Peters, 1994, p. 80). Trust is the outcome of a proper psychological contract between company and employee, when the exchange relationship of what one will give and get in return matches the organisation's expectations of fair exchange.

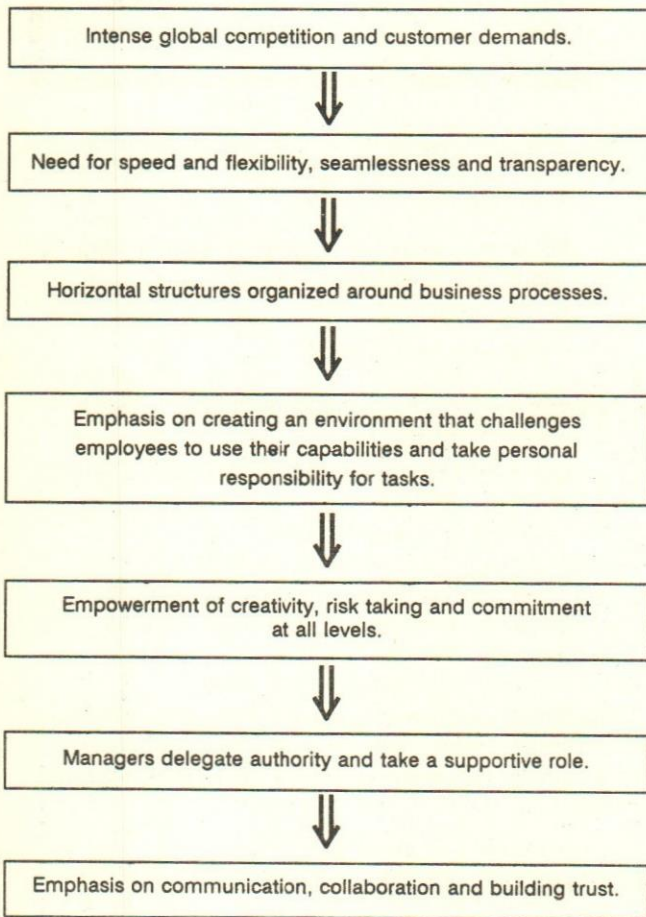


Fig. 1. The Need for Employee Empowerment

The empowering attitude can be developed by management through trust and other allied training programs like organisation development and quality of work life. In order to develop the mindset of the people an attempt may be made to educate people in the new order to develop a repertoire of empowerment skills through continuous training programs like effective listening, effective communication, supportive behaviour and Kaizen.

### Leadership Building

The ability, commitment, situation, self-confidence of their own judgment, authority, attitude, initiation, hardworking are the qualities of a person which are unfolded in the process of empowering culture. The above said qualities develop gradually by involving everyone in the process of decision-making. In the new order of empowerment, the people are required to act as co-ordinators and guardians, facilitating the all round development of employees, which necessitates concerted efforts to build empowering leadership.

**Leaders need to have the capacity to understand the strengths and weaknesses of people to support them to make use of their talents and skills.**

Empowering leadership can be built for empowering people as well as liberating organisations. Leaders need to have the capacity to understand the strengths and weaknesses of people to support them to make use of their talents and skills. Leaders are to sense and prevent any physical and social disabilities which hamper employee performance. The empowering leadership can facilitate the process of liberating the organisation—by developing organisation's structure which necessitate collective involvement in decision-making. An empowered leader can cause a basic shift in the nature of control and authority in organisation's settings. Empowering leadership does not focus exclusively on the individual manager as hero, but looks at the group or organisation development process as a whole (Bradford and Cohen, 1984).

Empowering leadership leads to improvement in (Hayward, 1995):

- responsiveness to customer needs
- initiative and creativity
- speed of decision making



- motivation
- commitment to successful outcomes at all levels.

### **Role of a Manager**

Murrell & Vogt (1991) illustrate the six roles—informing, decisions making, planning, evaluating, motivating, and developing that make up the infrastructure of an empowering organisation. In these roles, the leaders may have the opportunities and challenges in reinforcing their ideas and are discussed below.

*Informing Scenario*—A manager in an empowering organisation must establish and maintain the technical aspects of information exchange, more importantly, he or she must also establish and maintain a climate of trust. A high level of personal trust is essential to the flow of valid information (Gibb, 1978). A climate that values individual input, operational information, and personal/group assessment and perspective dramatically enhances an organisation's empowering ability. In an empowering organisation the manager assumes responsibility for sharing data relevant to team members' jobs as well as information about the strategic and spiritual essence of the organisation. The manager also creates feedback mechanisms and interactive systems of communication. In an empowering organisation, all members invest time and energy in developing and clarifying information—sharing guidelines and procedures.

*Decision Making:* An empowering manager functions by inviting the people to participate in decision making, incorporating a review process that reach downward in the organisation. In an empowering organisation, the final decision is moved to the point that is most appropriate in terms of information, expertise and need.

*Planning:* In an empowering organisation, planning involves as much as possible of the people impacted by the planning process. Participative planning is neither the easiest nor the fastest way for an organisation to sort out its plans.

*Evaluation:* An empowering evaluative system builds on the process of valuing and takes advantage of what is learned in that process to improve performance. An empowering evaluation strategy is self-diagnosis, in which a manager gives support and encouragement in response to an employee's request.

*Motivation:* Pride in accomplishment is a powerful motivator, in a work environment. The strongest motiva-

tion factors like pride are intrinsic. Therefore, empowering managers do not rely on extrinsic incentives like pay or punishment. Rather, they empower by example—being role model, coach, counselor, director and so on. Empowering managers help to structure the organisation so that its reward systems are consistent with its goal of developing self motivated individuals. Motivation, like evaluation, is at the core of the empowerment process.

*Development:* A fully empowering organisation uses all the skills and ideas available to it, it also ensures its continual growth and survival by responding to a changing external environment. The empowering manager's daily tasks are developmental in perspective. This perspective requires an on-going research for improvement and constant attention to developing higher levels of performance. Empowering manager think in terms of creating a better and more effectively developing organisation.

Empowering managers are candid but they are politically astute. They are risk takers and are smart enough in knowing when the organisation will not support their efforts and ideas. An empowering manager is a self-motivated person with ethical framework that makes all of his or her interactions important.

Leadership that excites, energizes, motivates and liberates others, is the essence of empowerment (Vogt and Murrell, 1990). When managers shift their emphasis from control to empowerment, their images of power and leadership also shift. Power becomes something that is within a person and that can be created as well as distributed. Effectively developing that power is empowerment, and leadership becomes an essential ingredient for effective empowerment.

The empowered work place is characterized by (Scott and Jaffe, 1991):

- Enhancing the content of the work.
- Expanding the skills and tasks that make up a job.
- Liberating creativity and innovation.
- Greater control over decision about work.
- Completing a whole task rather than just portions of it.
- Customer satisfaction.
- Market place orientation.

Tray (1994) describes ten principles of empowerment by illustrating them through a structure called "Power Pyramid".

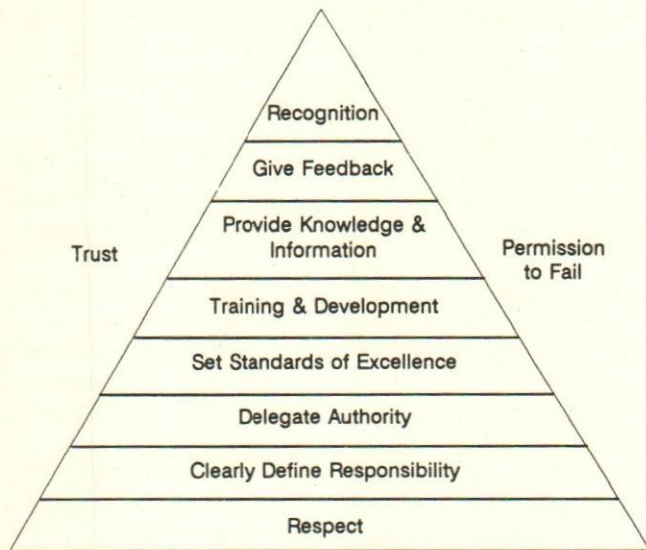


Fig. 2. Power Pyramid

Conclusively, towards empowerment, an organisation should develop and nurture a climate/culture. Leadership is the primary factor for empowering organisations which should initiate the process. This could include.

- (a) encouraging information sharing, resource sharing and participative management through formal and informal changes in organisation design,
- (b) teaching employees to examine their own values and belief systems concerning individual autonomy and behavior, and
- (c) teaching employees techniques to enhance their communication and influencing skills.

## Conclusions

Due to globalization and liberation of economies, change in organisations has become inevitable. The bureaucracy and method of control mechanism would not be effective. Due to competition a wide range of products and services are available in the market. Customers have many choices of products through which they expect quick response. Therefore, organisations have to either react to the changes and/or create changes in the environment. Towards this, there is a need for organisations to empower their employees.

Empowerment is an individual affair. It comes from acting on our enlightened self-interest. Empowerment is the process of delegating authority and responsibility to the lowest level in order to ease the dependency. In working with organisations, to improve the climate for empowerment, clarity of purpose, morale, fairness,

motivation, recognition, teamwork, participation and communication are the most important factors.

**Empowerment is the process of delegating authority and responsibility to the lowest level in order to ease dependency.**

Researchers do have a significant role in the process of diffusion and implementation of empowerment and in highlighting the benefits and make the management realize the need for empowerment. In Indian context, a lot more research is needed to demonstrate the importance of empowerment in the organisations. The documented research findings on empowerment can help the management trainers to design training programs which would aid/help to prepare the employees at all levels, to accept empowerment and utilize it effectively for the growth of selves and organisations. The shift from getting the job done to attending to process, taking responsibility for the development of whole organisations and solving problems using active learning, is at the core of empowerment.

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# Economics of Waste Collection & Recycling in Urban Informal Sector

P. Thippaiah

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*Rapid urbanisation has failed to create more employment in the organised sector. As a consequence, a major proportion of the labour force instead of remaining idle and unemployed have taken up small self-employed activities in urban informal sector for their survival. In the informal sector, waste recycling is one of the important segments which is playing a major role in generating employment and income to the weaker sections of the urban society. Within this segment, a large section of people are involved in various stages and performing particular kinds of work. For instance, the artisanry group is engaged in collection of metal tins, iron pieces and other materials from the waste material dealers and produces very useful goods for the use of urban labour. Although the conditions of wholesale dealers of waste materials are better, the conditions of waste pickers are economically and socially most vulnerable. It is stressed that the government or municipal corporations take steps to improve their socio-economic conditions.*

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## Introduction

Many cities and towns in the third world countries have experienced rapid urbanisation due to migration, large scale industrial and commercial developments. However, such developments have failed to offer sufficient jobs for the rapidly growing labour force. As a consequence, a large number of them prefer to stay in a wide range of self-employed and wage employment activities in the urban informal sector. At present, this sector is playing a useful role in generating income and employment for the urban poor.

The concept of informal sector, encompasses a variety of activities such as waste collection, processing, recycling of waste materials, manufacturing, trading and servicing. These activities run on a smaller scale in urban areas. Among the informal sector activities, waste recycling has been recognized as an important segment in urban economies in recent years. This sector, though prevalent in many countries, only in recent years, steps are being taken to improve the waste collection and recycling methods in order to check environmental degradation. The necessity of this was felt on the grounds that it is not only supplying some of the scarce materials and controls the depletion of scarce resources in the forests and mines which are needed for the future generation and production, but also provides employment to the urban poor. With the support of urban scrap merchants, the activity of waste collection is coming up in rural areas too. So the improvement of this sector is

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really an urgent one in underdeveloped as well as in developing countries where the raw materials and capital are scarce. It is in this context, that a brief exposition is made in this paper on waste recycling, as a part of Urban Solid Waste Management (USWM).

### Characteristics of Waste Pickers

The waste recycling industry has created a labour market with some interesting features. The poor and the people belonging to lower caste are found in collection of wastes, whereas, the members of rich and higher caste are engaged in more profitable occupations such as wholesale dealing of waste materials, manufacturing and trading of recycled goods. The characteristics of the waste pickers are: (1) They mostly belong to migrant category; (2) their place of settlement in urban areas is usually slums, pavements, waste collection shops or open space of shops; (3) the education and skill levels are low; (4) they do not possess sufficient capital to undertake any kind of business; (5) their assets for carrying out any kind of business are inadequate; (6) their nature of work, working hours, place of work varies from time to time, and (7) there are few hurdles for carrying out their business. Because of these characteristics, the waste collectors not only have low economic status and acute poverty in the society but also suffer from insecure and irregular jobs. Even then they are extracting useful materials from the urban wastes. These form raw materials to the recycling industries in urban areas.

This activity is organised through a chain of ragpickers, collectors, self-employed individual entrepreneurs or a group of dealers and agents. There are no official estimates on these aspects and also the number of units engaged in waste recycling industry. However, some conservative estimates are available on ragpicking. According to these estimates, there were 20,000 to 30,000 ragpickers in Bangalore (Huysman, 1994: R-7), 8,000 to 10,000 in Madras (Sundaram and Dhanalakshmi, 1994: R-35), 35,000 in Hyderabad (Baud, 1994: R-41), 10,000 (children) in Delhi (Financial Express, 1994: p.5), 20,000 in Ahmedabad (Joshi 1994: p.1) and 12,000 in Bombay (Rao, 1994: p.36) are engaged in waste collection. They comprise 60 per cent children, 30 per cent women and 10 per cent men (Venkateswaran, 1994). In addition, there are a number of itinerant buyers in these cities.

**The waste collectors not only have low economic status and acute poverty in the society but also suffer from insecure and irregular jobs.**

Their number is 1000-1200 in Bangalore, 3,000 in Madras and 2,000 in Hyderabad. The small dealers are estimated to be 600 to 1000 in Bangalore and 2000 in Madras. The number of wholesalers in different places are 50 in Bangalore, 215 in Madras and more than 100 in Hyderabad.

### Stages of Waste Recycling

Whatever may be the estimates, one thing is clear that, a large number of people are involved in the resource recovery process, which consists of various stages or segments right from the stage of waste collection till the marketing of the final product.

In the first stage, a large number of waste collectors are involved and they are persons who move from place to place in search of wastes and they are treating waste as an ore. By doing this, they are not only helping the society in saving scarce raw materials and energy, but are also helping themselves. They can be classified into two categories: (a) waste pickers and (b) waste buyers. In the first category again we find three groups. The first group comprises men, women and children who move along the streets before the city corporation scavengers sweep the streets and pick up the waste papers, iron pieces, broken glass pieces, plastic papers, tablet papers, bones, cutlery, jewellery, shoes, clothes and cardboard from the city streets and road side dustbins. The men and male child workers prefer the streets and women and girl children heavily prefer garbage and industrial dumps for their collection. The second comprises domestic servants who collect waste at the point of origin and, the third comprises city sanitation workers who gather the valuables from the urban solid waste as they load it on to the garbage trucks. The individual earnings of all these category of collectors ranges between Rs. 30 and Rs. 40 per day.

The second category is itinerant (travelling) buyers exclusively comprising of men force. They move in and around all the localities of the city normally with a bicycle and approach the waste originators (households, offices, and commercial and industrial establishments) and collect the old materials, such as empty bottles, gunny bags, tins, old news papers, used stationary, magazines, cans, broken glass (cullets), iron scraps and other metals on payment. Within this group, the Stainless, Aluminium and Plastic sellers exclusively deal with new finished products. But they give new goods for old ones (barter system). All the street, domestic, municipal workers and itinerant waste collectors sell their collected material to the small dealers, who eventually sort out the material by employing women or children and sell them to the wholesale

dealers. The earnings of itinerant buyers are around Rs. 75 to Rs. 100 per day. These earnings are definitely higher than the earnings of an unskilled worker in an industry and higher than that of rural agricultural labourers.

The waste collectors' work in the streets, though simple and easy to learn, the collectors have to maintain high speed to move from one place to another in search of more wastes. They do not require any capital or assets, except a big polythene bag. Nobody's permission is required to start this occupation. But they require prior knowledge of waste materials, weighing instruments and scales. With regard to waste paper and bottles, the collectors should have knowledge of what is useful and what is not. However, they acquire these skills as they do their job. The other category of pickers namely the itinerant buyers possess cycles, big baskets, weighing instruments and some capital for carrying out their business. A few of them have either their own houses or rented houses in the city and the remaining of them are taking shelter in retail or wholesale dealer shops. Any semi-unskilled person can also start this kind of activity by observing other collectors. But to earn a decent income in this occupation, it requires experience. Both collectors and itinerant buyers are well aware when to work and when not to work, but they do not have knowledge about the fluctuations of prices for their output. Only the wholesalers and recycling industries are aware of this, but they do not put it into practice while purchasing the output from the various collectors. In this way they are exploiting the collectors and making lot of profits.

**The waste collectors' work in the streets, though simple and easy to learn, the collector have to maintain high speed to move from one place to another in search of more wastes.**

In the second stage, we find a number of waste purchasing shops based in slums or peripheries and busy market places. The dealers are the smallest participants (with a fixed location) in the recycling sector in Bangalore. They form a link between sources of waste such as waste pickers, municipal waste collectors, itinerant waste buyers, households, factories and large traders (wholesalers). Each shop purchases one kind of waste from collectors. However, a few of them purchase all kinds of waste. Each one of them tries to maximize his profit by way of attracting more collectors by extending incentives such as advance money, gunny or polythene bag, baskets, festival gifts, free shelter, sub-

sidised food, cycles etc. The mohalla buyers, after getting few quintal of wastes, sort out and send it to the big waste and scrap merchants (wholesale dealers).

The third stage is somewhat organised in nature. The problems of capital and accommodation for preserving the purchased materials do not arise here. They are a group of wealthy waste material dealers, situated in busy market places. They are specialised in dealing with one type of material. For instance, one deals with iron scraps and so on. The bulk buyers always take steps to sort out the output into different grades by employing few labourers, before selling. Such sorted items normally would be sold to the artisans mostly located in nearby slums or to shops who want them for repair work or for manufacturing consumer durables. The empty bottles that are obtained from pickers were to be sold to distilleries and laboratories for reuse. The bulk buyers also sell their metal scraps which is not useful to make any new item to various small and large scale (formal sector) industries. They use them in varying proportions to substitute virgin materials in the manufacturing process. This type of sorting and selling helps the bulk traders to earn larger profit.

**The bulk buyers always takes steps to sort out the output into different grades before selling. Such sorted items normally would be sold to the artisans or to shops who want them for repair work or for manufacturing consumer durables.**

In the fourth stage, we find a large number of micro-enterprises and artisans in the informal sector, producing a variety of cheap mass consumption goods for the lower income groups in the urban society by using the materials which are recovered from various sources. They are carrying out these activities at home or on foot paths or in temporary structures. Their access to water and electricity is very limited. Though they are far from gujari shops (second hand raw-material wholesale shops), they visit these shops and pick out the required raw material like metal sheets, scraps, large tins, bolts and nuts, resin sheets at cheaper prices. By making use of these second hand materials, the artisans are now producing a variety of consumer goods (household goods). However, the participants in this sector to some extent are depending on the organised sector for virgin materials with a view to make the recycled products more attractive. A study carried out by Abdul Aziz on waste recycling industry in Bangalore shows that about 1,400 enterprises with 2,500 workers which constitutes 2.7 per cent of the total urban informal sector employ-

ment of 93,731 in Bangalore city produce such recycled goods worth Rs. 1.03 crores (Aziz, 1984: p.57-59).

In the last stage, the artisans market the finished products for the urban poor by keeping them in foot paths. Sometimes they also sell to the retail shops and to the organised shops on order basis. The shops which give orders to such goods are well organised and are regulated by the rules and regulations of the Government. Lack of capital and accommodation to these business enterprises does not arise like in other stages. The goods once reached here, get more demand than the similar goods sold in the streets by the informal manufacturer of artisans. Because of this influence, the well established business people are running their business very smoothly and thereby improving their economic status, through high prices. In other words, once the goods reached the organised shops they would get more demand, as the customers buy them thinking that they were produced in the factories by using original raw material. As a result, the organised shop owners get more profit than the artisans who actually produce these goods.

While all the above stages, though help the economy by way of waste reduction, recovery and efficient management of urban solid wastes, the working conditions of the ragpickers in the first stage are quite bad. They are the people who are the most disadvantaged section in the urban labour market enjoying the lowest level of literacy and income. Their working conditions are also precarious. They are prone to various occupational diseases such as skin and respiratory problems because of their continuous exposure to the garbages. They have not been duly recognised by government and extended credit programmes for taking up other productive ventures. Their collection in several instances fails to bring in reasonable income, because of exploitation by junk traders, police and price fluctuation of wastes in the market.

These problems are bound to exist due to absence of government, civic bodies intervention in solving their problems. The absence of unionism and ignorance of the uses of the formation of the unions

**The absence of unionism and ignorance of the uses of the formation of the unions to fight for their rights is also responsible for their pathetic conditions.**

to fight for their rights is also responsible for their pathetic conditions. Knowing these conditions and the problems, one should not neglect the welfare of this unorganised section which is producing wealth from urban wastes.

### Suggestions

In order to ensure better living conditions for this category of workers the following suggestions may be considered by the government or civic bodies on priority basis:

1. The collector of wastes should be given an identification card or licence to overcome the harassment by the police, public, shop keepers and Municipal/Corporation officials. No doubt some steps were initiated in this direction by way of issuing identity cards for the ragpickers in various cities with an objective of relieving the children from the police and public harassment. However, they are inadequate compared to the magnitude of ragpicking in several cities.
2. Guidelines should be issued to the banks to provide finance at low rates of interest to the waste pickers, artisans who are producing very useful items from waste metal scraps. The schemes such as Nehru Rozgar Yojana (JRY), Differential Rate of Interest Scheme (DIR) and Prime Minister's Rozgar Yojana (PMRY) should be extended to improve the status of the pickers and promote recycling industry.
3. A large number of waste collectors do not have any roof over their head. As such, many of them are taking shelter in hume pipes, bridges, railway and bus stations facing several problems. In view of this, several NGOs in major cities have started "Night Shelter Houses" for ragpickers and street children. But this scheme is accommodating only a small proportion of child workforce in this sector. Therefore, more shelter homes should be constructed for the waste collectors by the corporation or the municipal authorities.
4. Instructions should be issued to households, commercial and business establishments and Municipal authorities to separate the wastes into dry, non-organic and wet (organic parts) and give the recyclable items directly to the pickers. This would enable the ragpickers not only to get less dirty material, but also help in improving the quality of the recycled product and ultimately help the picker to improve his health condition.

5. The ragpickers are working for the organised industries indirectly by way of extracting ores from garbages and efficiently managing the urban solid waste. Therefore, these workers should be treated as workers and the welfare measures designed for organised sector workers should also be extended to these groups.
6. Steps should be taken by the government not to destroy some of the waste materials e.g. burning of garbages and waste papers by the Government departments.
7. Waste collection co-operative societies should be established in towns and cities to purchase wastes from pickers to avoid price fluctuations and to promote the waste recycling and marketing the products made out of waste materials. This measure will ensure better income to the ragpickers as well as recyclers.

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# Productivity, Labour Use and Wages: A Post Green Revolution Analysis of Punjab Agriculture

Jaswinder Kaur and Bant Singh

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*Consequent to green revolution, Punjab has been in the forefront in agricultural productivity in all crop sectors. Of course frequent changes in technology and factor-product prices have led to massive changes in input-output structure of agricultural products. The present paper details the findings of a study examining the growth in farm productivity of small, medium and large size group farms in the state. Besides examining the shift in use of farm labour, changes in wages and farm earnings of agricultural workers have been dealt with.*

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## Introduction

Punjab has been in the forefront of the spread of green revolution in India. Frequent changes in technology and factor-product prices since late sixties and early seventies have led to massive changes in the input-output structure of the state agriculture. Product-mixes, which were fairly diversified until mid seventies, turned out to be almost monocultured with wheat in rabi and paddy/cotton in kharif season in the mid-eighties. The shift of cropping pattern in favour of wheat and paddy was the result of the introduction of high yielding varieties and relatively stable and remunerative prices of these crops. Consequently, the farm input structure in the state has also undergone phenomenal changes. With the technological upgradation, the role of the conventional factors of production like land and labour has subdued and that of capital and management increased. These changes in the farm sector have on the one hand increased the farm productivity by more than 100 per cent while on the other hand have also affected the use of different resources on the farm. Besides other factors, the use of labour has been affected in a variety of ways. Its employment has witnessed shifts in its use patterns and wage rates in different regions and size group farms in the state. In the context of micro and macro level planning and formulate broader agricultural policy for the state, it is pertinent to examine these changes with reference to state agriculture during the post green revolution era. The present study aims:

1. to examine growth in farm productivity on small, medium and large size group farms in different regions of Punjab during post green revolution period from 1971-72 to 1991-92.
2. to examine the shift in the use of farm labour on different size group farms, and

- to study the changes in wages and earnings of agricultural labourers in different regions of Punjab from 1971-72 to 1991-92.

### Source of Data

The data used in this centrally sponsored study have been taken from the Department of Economics and Sociology, Punjab Agricultural University, Ludhiana. Data on farm output and human labour use of different categories of farm workers, i.e. cultivators, attached farm servants and casual hired labour on different size group farms has been taken at two points of time, 1971-72 and 1991-92, representing early green revolution period and maturity stage of post green revolution period, respectively. Additional data on wages and other related aspects were collected from different issues of the Statistical Abstracts of Punjab for the relevant periods.

### Formation of Homogenous Regions & Size Classes

Human labour use and productivity on the farms primarily depend upon the types and frequency of the crop grown. Punjab State, although small in geographical coverage, has wide variations with respect to the types of crops grown and other physical and ecological features. The State has, therefore, been divided into the following three homogenous regions on the basis of cropping pattern and physical and ecological factors:

Punjab State, although small in geographical coverage, has wide variations with respect to the types of crops grown and other physical and ecological features.

**Region-I:** includes the north-eastern districts of Gurdaspur, Hoshiarpur and Ropar. These districts receive high rainfall and have medium irrigation facilities. A large part of these districts falls under sub-montaneous tract with deep underground water table. Paddy, maize and sugarcane in kharif and wheat in rabi are the principal crops of this region. Farm productivity in this region is low as compared to the other two regions.

**Region-II:** consists the districts of the central belt of the state, viz., Amritsar, Jalandhar, Kapurthala, Ludhiana, Patiala, Fatehgarh Sahib and Sangrur. These districts receive medium rainfall but have good irrigation facilities through shallow tubewells and canals. The productivity in this region is, thus, highest over the other

two regions. Paddy and Sugarcane in kharif and wheat in rabi are the major crops of this region.

**Region-III:** comprises the relatively drier districts of the south-western part of the state and includes the districts of Bathinda, Ferozpur, Mansa, Moga and Faridkot. These districts receive less rainfall than other parts of the state. Subsoil water in larger area of this region is brackish and, thus, is not good for irrigation. So canal water is the main source of irrigation in this region. Cotton (in some areas paddy too) in kharif and wheat and sarson in rabi are the principal crops of this region. The productivity in this region is midway between the other two regions.

The sample holdings of the Comprehensive Scheme for the year 1971-72 and 1991-92 taken for the present study were, therefore, arranged into the above defined three regions and were further categories into small, medium and large size groups with operational area upto three hectares, three to six hectares and above six hectares respectively. The sample distribution and average size of operational holdings of different size group farms in three regions of the state is given in Appendix-I.

### Observations

#### Growth in Farm Productivity

The direct impact of various technological changes associated with the new farm technology has been a spectacular increase in the yield of major crops of wheat and paddy in different regions of the State. For making comparison with respect to changes in productivity over the years, instead of taking individual crops, we have taken farm unit as a whole and have considered all the crops grown on the farm during the years under reference. Farm productivity in the present sense has been taken as gross output value per hectare at post-harvest prices both from the main products and by-products taken during the year and was worked out as under:

$$\bar{Y}_{jk} = \left( \frac{1}{\sum_{i=1}^{n_{jk}} a_{ijk}} \right) \sum_{i=1}^{n_{jk}} \sum_{c=1}^{n_{ijk}} Q_{cijk} \cdot P_{cijk}$$

Where:

$\bar{Y}_{jk}$  = Gross output value per hectare on the jth size group farm in the kth region.

$a_{ijk}$  = cultivated area of ith farm of jth size group in kth region.

$n_{jk}$  = number of farmers selected in jth size group in kth region.

$n_{ijk}$  = number of crops grown on ith farm on jth size group farm in kth region.

$Q_{cijk}$  = quantity of cth crop product on its farm in jth size group farm in kth region.

$P_{cijk}$  = price per unit of the cth crop product on ith farm in jth size group farm in kth region.

The regional and state averages were worked out from size group estimates as under:

$$\bar{Y}_k = \frac{1}{100} \sum_{j=1}^n A_{jk} \cdot \bar{Y}_{jk} \quad \text{and}$$

$$\bar{Y} = \frac{1}{100} \sum_{k=1}^m A_k \cdot \bar{Y}_k$$

Where:

$\bar{Y}_k$  = Average productivity per hectare in region k.

$\bar{Y}$  = Average productivity per hectare in state as a whole.

$\bar{Y}_{jk}$  = Average productivity per hectare on jth size group farms in kth region.

$A_{jk}$  = Per cent area cultivated under jth size group to total farms area cultivated in region k.

$A_k$  = Per cent area cultivated in region k to total cultivated area of the state during the year under reference.

For making comparison in productivity over two periods of time gross output value per hectare, thus

worked out for different size group farms and regions was deduced to common base year prices by deflating the estimates of 1991-92 to 1971-72 prices using post-harvest price index and the estimates are presented in Table 1. The growth in productivity was measured in terms of increase in gross output value at constant prices over the period under study. The productivity (gross output value per hectare at constant prices) on an average farm in the state as a whole has increased by 73.74 per cent from Rs. 2762 in 1971-72 to Rs. 4797 in 1991-92. With regard to growth in productivity in different regions, Table 1 shows that, due to better irrigation facilities, the productivity in Region II was higher over the other two regions during both the periods under study. However, absolute increase in productivity during this period has been higher in Region III than that in Regions I and II. Despite the fact that Region III is relatively water scarce and semi-arid in comparison to the other two regions, the reasons for higher increase in productivity in Region III were the rapid increase in irrigation facilities due to lining of water channels, installation of deep tubewells by large farmers and the cultivation of short duration high yielding varieties of cotton since mid-eighties. Due to these reasons, besides, increase in the yields of major crops the cropping intensity on the sample farms in Region III has increased by over 30 per cent as against nearly 7 per cent in Region I and 14 per cent in Region II (Appendix I). The productivity in Region I remained low due to physical characteristics of the area such as deep underground water table and uneven topography in larger areas.

With regard to the increase in productivity on different size group farms, Table 1 shows that productivity increased at a greater rate on large farms than on small and medium sized farms in all the regions of the State. In the State as a whole productivity on large farms increased by about 116 per cent from Rs. 2287 per hectare

**Table 1:** Productivity (Gross value output per Hectare at Constant prices) on Small, Medium and Large size Group Farms in Different Regions of Punjab in 1971-72 and 1991-92

Region	Productivity in 1971-72				Productivity in 1991-92 (in rupees at constant prices of 1971-72)			
	Small Farms	Medium Farms	Large Farms	Average Farms	Small Farms	Medium Farms	Large Farms	Average Farm
I	2412	2142	1806	2210	3452 (43.12)	3683 (71.94)	3478 (92.58)	3501 (58.42)
II	3261	3058	2419	3175	5286 (62.09)	5622 (83.84)	5804 (139.93)	5405 (70.24)
III	2928	2570	2288	2566	4910 (67.71)	4500 (75.11)	4389 (91.91)	4533 (76.72)
State as a whole	2871	2708	2287	2761	4634 (61.41)	4895 (80.76)	4931 (115.61)	4797 (73.74)

Note: Figures in parentheses indicate percentage increase in productivity in 1991-92 over 1971-72.

ture in 1971-72 to Rs. 4931 in 1991-92 whereas on small and medium farms the increase in productivity was only 61 per cent and 81 per cent respectively. The faster increase in productivity on large size group farms qualifies the fact that new farm technology is capital intensive and has benefited the large farmers more than the small farmers. Consequently, the size productivity relationship which was inverse in early green revolution period (1971-72) turned out to be direct in latter period (1991-92) because small farmers due to resource constraints, could not apply different inputs in adequate quantity and also at the right time.

**With regard to the increase in productivity on different size group farms, productivity increased at a greater rate on large farms than on small and medium sized farms in all the regions of the state.**

#### Estimation & Shift in the Demand for Labour

Continuous changes in farm technology and factor-product prices during the post green revolution period since late sixties and early seventies, have brought drastic changes in cropping pattern and increased farm productivity of major crops on one hand, have also resulted into significant changes in the pattern of input use on the farms. In Indian agriculture, where land available for cultivation is strictly limited in supply, there is little room for changes in adjustments in resource-mix with respect to land. So changes in resource-mix shall have to be based largely on adjustments in labour and capital inputs. There is no denying the fact that new farm technology is capital intensive and demand and capital has increased on all the size group farms but it cannot be said with certainty with respect to labour because some technological developments have been labour saving and some others labour intensive.

The gross labour use per hectare of cultivated area on different size group farm in different regions of the state has been worked out by summing up different

**In Indian agriculture, where land available for cultivation is strictly limited in supply, there is little room for changes in adjustments in resource-mix with respect to land.**

types of labour used on the farms, i.e., men, women and child labour from family, attached servants and casual labour employed during the year under reference as under:

$$\bar{L}_{jk} = \left( 1 / \sum_{j=1}^{n_{jk}} a_{ijk} \right) \sum_{j=1}^{n_{jk}} \sum_{c=1}^{n_{ijk}} L_{scijk} \quad \dots (i)$$

$$\bar{L}_{jk} = \sum_{s=1}^m L_{s_{jk}} \quad \dots (ii)$$

Where:

$s = (1, 2, 3, \dots, m)$  represent different categories of workers i.e., family labour, attached labour and casual labour of men, women and children.

$\bar{L}_{jk}$  = Total labour used of  $s$  th category per hectare.

$n_{jk}$  = Number of selected cultivators in  $j$  th size group farms in region  $k$ .

$a_{ijk}$  = cultivated area of  $i$  th farmer in  $j$  th size group farms in region  $k$ .

$L_{scijk}$  = labour employed of  $s$  th category on  $c$  th crop on  $i$  th farm of  $j$  th size group in region  $k$ .

$\bar{L}_{jk}$  = average human labour use of different types of labour per hectare on  $j$  th size group farms in region  $k$ .

Human labour use of different categories of farm workers, i.e., family labour, attached labour and casual hired labour; and aggregate labour use of all these categories per hectare of cultivated area for different size group farms and regions of the State during 1971-72 and 1991-92 and changes therein over these years are presented in Table 2. The table shows that per hectare aggregate demand for labour has increased, but in different proportions, on all size group farms and regions in the state during the years under reference. Per hectare aggregate human labour demand in the State as a whole has increased by about 16 per cent from 939 man hours in 1971-72 to 1089 man hours in 1991-92. Despite the increased use of weedicides and mechanisation which are considered to be labour saving technologies, the human labour use on all size categories of farms in all the regions of the state has increased; this is due to, (i) increase in productivity of the crops through higher use of yield increasing inputs like improved seed and chemical fertilizers; (ii) change in cropping pattern from less labour intensive crops and (iii) increase in cropping intensity on the farms.

As shown in Table 2, the per hectare human labour demand for crop production has increased in greater

**Table 2:** Changes in Human Labour Demand (per hectare) on Different Size Group Farms in Different Regions of Punjab during 1971-72 and 1991-92

(in man hours)

Region	Size category	Human labour use in 1971-72				Human labour use in 1987-88			
		Family labour	Attached labour	Casual hired labour	Total labour	Family labour	Attached labour	Casual hired labour	Total labour
I	Small	771	50	86	907	652 (-15.43)	26 (-48.00)	317 (268.60)	995 (9.70)
	Medium	565	84	195	844	511 (-9.56)	26 (-69.05)	391 (100.51)	928 (9.95)
	Large	287	230	237	754	286 (0.00)	75 (-67.39)	474 (100.00)	835 (10.74)
	Average	617	90	150	857	489 (-20.74)	42 (-53.33)	412 (174.67)	943 (10.02)
II	Small	933	82	93	1108	893 (-4.28)	22 (-73.17)	400 (330.10)	1315 (18.68)
	Medium	583	269	244	1096	523 (-10.29)	128 (-52.41)	524 (114.75)	1175 (7.20)
	Large	328	331	247	906	360 (9.75)	155 (-53.17)	465 (88.26)	980 (8.17)
	Average	647	248	183	1078	568 (-11.49)	126 (-49.19)	495 (170.49)	1189 (10.30)
III	Small	713	58	126	897	766 (7.43)	56 (-3.45)	294 (133.33)	1116 (24.41)
	Medium	562	123	147	832	545 (-3.02)	124 (0.00)	373 (153.74)	1042 (25.24)
	Large	281	201	188	670	319 (13.52)	224 (11.44)	377 (100.53)	920 (37.31)
	Average	592	106	142	840	595 (0.00)	116 (9.00)	346 (143.36)	1057 (25.84)
State as a whole	Small	820	73	104	997	760 (-7.32)	30 (-58.90)	373 (258.65)	1163 (16.65)
	Medium	572	190	207	969	528 (-7.69)	109 (-42.63)	452 (118.75)	1089 (12.38)
	Large	297	268	221	786	346 (16.49)	168 (-37.31)	423 (91.40)	937 (19.21)
	Average	606	167	166	939	558 (-8.60)	108 (-35.33)	423 (154.82)	1089 (15.98)

**Note:** Figures in parentheses indicate percentage increase in human labour demand in 1991-92 over 1971-72.

**Despite the increased use of weedicides and mechanisation which are considered to be labour saving technologies, the human labour use on all size categories of farms in all the regions of the state has increased.**

proportion on large farms than on small and medium farms. Since Region III is predominantly cotton growing area and no weedicides is used on cotton crop which could replace human labour demand for hoeing and weeding operations and thirdly, the impact of mechanisation to replace human labour use has been

less in respect of cotton crop than that on paddy crop<sup>1</sup> grown extensively in Region I and II.

As for changes in the use of different types of labour, i.e. family labour, attached labour and casual hired labour, Table 2 also shows that the demand for casual labour over the years from 1971-72 to 1991-92 has increased phenomenally between 100 to 300 per cent on different farm situations while the use of family

1. H.K. Bal, Bant Singh and H.S. Bal in their study, "Analysis of Demand for Farm Labour and its Substitution with other Factors of Production for Punjab Agriculture" "Agricultural Situation in India" Vol. 42(1), 1987, have worked out mechanisation scores at 1.903 for wheat, 1.394 for paddy and 0.621 for cotton on the basis of extent of mechanisation of different farm operations of these crops.

and attached labour has decreased on most of the farms in all the regions of the state. On an average farm situation in the State, the demand for family and attached labour over the years under reference has decreased by about 9 per cent and 35 per cent respectively, while for casual labour the demand per unit of cultivated area has increased by over 154 per cent. This shows that casual labour has substituted to a large extent both for family labour and attached labour. The main reason for increase in casual labour demand in period II over period I was the intensification of cropping pattern in period II and hence the demand for seasonal labour increased. While in the lean periods the demand for labour decreased. So many farmers instead of engaging attached labour preferred to get the work done on casual hiring basis. Attached labour was mostly engaged for cattle tending rather than for crop cultivation. Secondly, due to the increase in yields and wage rates, agricultural labourers too preferred to work on casual basis than as attached servant which they consider as a sort of bondage labour. Thirdly, mechanisation has reduced the family and attached labour demand but has increased the seasonal demand for casual hired labour. Furthermore, the farmers especially from the large size categories have now developed preference for leisure and get most of the work done by casual hired labour.

### Changes in Wages and Earnings of Agricultural Labourers

Annual gross earnings of an average farm servant and wages revealed 150 per cent increase in casual labour demand (Table 2) over the of casual hired labour during the study periods 1971-72 and 1991-92 worked out for different regions of the State are presented in table 3. It can be seen from this table that despite more than period under study the real wage rates of casual hired farm labourers did not increase appreciably. Although, at current prices the average wage rates have increased by about 450 per cent during the years 1971-72 to 1991-92 but at constant prices this increase in wage rates has been insignificant. After mid-seventies there had been continuous inflow of migrant agricultural labourers into Punjab which depressed wage rates in peak periods.

The earnings of attached farm servant at constant prices have rather decreased considerably in all the regions of the State over the study years (1971-72 to 1991-92). With respect to different regions the decrease in earnings of annual servants have been higher by more than 30 per cent in Region I followed by 19.75 per cent in Region II and 15.60 per cent in Region III. It has been because of the reason cited earlier that demand for attached labour in the latter period has decreased

considerably (Table 2) and most of the attached labourers engaged by the farmers in the state are migrant labourers from U.P. and Bihar and are kept primarily for cattle tending. These labourers are available on much lower wages than the local labourers. Hence real earnings of attached labour decreased in period II over period I in all the regions of the state.

**Table 3:** Annual payments of an average attached Farm servant and wages of casual agricultural labourer in different regions of Punjab during 1971-72 and 1991-92

Region	Payment for annual farm Servant in rupees per annual!			Wages of casual agril. labourer in rupees per day		
	1971-72	1991-92	Per cent increase in 1991-92 over 1971-72	1971-72	1991-92	Per cent increase in 1991-92 over 1971-72
I	1667	6052 (1164)	263.05 (-30.17)	6.33	35.07 (6.74)	454.03 (6.48)
II	1757	7332 (1410)	317.30 (-19.75)	7.26	36.97 (7.11)	409.23 (-2.07)
III	1853	8134 (1564)	339.96 (-15.60)	7.66	42.67 (8.21)	457.05 (7.18)
	1777	7421 (1427)	317.61 (-19.70)	7.08	38.58 (7.42)	444.92 (4.80)

**Note:** Figures in parentheses are values at constant prices deflated at 1971-72 prices using general consumer price index number for agricultural labourer in Punjab.

### Conclusions

The study has brought out that because of various technological and price factors the productivity (gross output value per hectare at constant prices) in the state has increased by more than 73 per cent over the years under reference from 1971-72 to 1991-92. The farm size productivity relationship which was inverse in early years of green revolution (1971-72) turned out to be direct in latter years (1991-92). The aggregate human labour demand on all the farm situations has increased. While the casual labour demand per hectare for crop production on an average farm in the State has increased by about 154 per cent from 1971-72 to 1991-92, the demand for family labour and attached labour on the other hand decreased by nearly 10 per cent and 35 per cent respectively. It was also observed that despite appreciable increase in productivity and demand for hired labour on all size categories of farms, the real wages of casual agricultural labourers have remained almost stagnant. While the earnings of attached farm servants instead decreased by about 20 per cent in 1991-92 over that in 1971-72. This clearly showed that in an agriculturally advanced state

like Punjab the agricultural labourers have not benefited much from new farm technology and secondly, there is no direct relationship between productivity increase and consequential wage rate increase in this part of the country. The wage rate determination is, thus, a purely demand and supply phenomenon.

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### Appendix I

Distribution of Sample Holdings into Different Regions and size classes, 1971-72 and 1991-92

Year/size class	Region-I	Region-II	Region-III	State as a whole
1971-72				
Small	11 (2.84)	15 (2.59)	11 (2.28)	37 (2.58)
Medium	16 (4.97)	27 (5.14)	24 (4.83)	67 (5.01)
Large	21 (8.92)	49 (11.83)	42 (12.76)	112 (11.25)
1991-92				
Small	23 (2.24)	51 (2.18)	36 (2.29)	110 (2.23)
Medium	25 (4.24)	23 (4.49)	37 (4.57)	115 (4.46)
Large	12 (9.69)	26 (8.42)	17 (9.10)	55 (8.91)

Note: Figures in parentheses are average size of operational holdings of the respective size class in hectares.

Trade restrictions could reverse re-engineering. The only other circumstance which could reverse it is a complete saturation of human desire.

— Michael Hammer

# Agricultural Labour Market Adjustments Through Migration: A Study

D. Suresh Kumar

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*The present study is taken up in North-western zone of Tamil Nadu to study the labour market adjustments across production environments. It is found that the labour market gets adjusted by permanent as well as seasonal migration and helps in income distribution. Migration of labour is seen as an important phenomenon in the adjustment of labour market in a given village or region or across villages. Policies to supply information on job opportunities in various regions, proper job counselling, assistance in moving from one area to another are to be strengthened so as to reduce the institutional barriers for inter-regional migration of workers. Participation in non-farm activities provides considerable employment opportunities to the labour households and this in turn reduces surplus labour which is dependent in agriculture. Hence, our policy in Human Resource Development should be reoriented to train rural people to participate in non-farm activities.*

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## Introduction

Consequent to green revolution, foodgrains production increased from 50 million tonnes previously to 185 million tonnes currently, thanks to fertilizer application and use of other plant protection chemicals, and high yielding variety seeds. Development of major and minor irrigation projects and other infrastructural facilities have gone up. But the overall gains have not been shared equitably, particularly by landless agricultural labour households, who form the bottom of rural income scale (Suresh Kumar and Ramasamy, 1993).

During the past three decades, the addition to the agricultural labour force has significantly increased. Of the total agricultural labour force, agricultural labour constituted 47.5 million in 1971 which increased to 55.5 million in 1981 and to 74.6 million during 1991. This is mainly due to demographic additions to the labour force, lack of effective population control measures, and slow expansion of non-agricultural sectoral employment. Hence, the question is how to ensure better and effective utilisation of the creative capabilities of the landless labour, who constitute a big reservoir of human resource and provide them with adequate wages for reasonable levels of living.

Unemployment and underemployment are the characteristic features of labour surplus economies like India. Scarcity of seasons of intense farm activities and surplus during slack periods alternating in cycles commonly met with. This cyclical phenomenon in labour demand determines the structure and pattern of rural labour market. The demand for labour in rural areas is determined by factors such as seasonality, effective demand for the output, production techniques employed, extent of commercialisation, degree of diversification, cropping pattern, cropping intensity, enterprise mix, stability of production, prevailing wage rates and availability of other co-operative factors of capital and land. As in the case of demand, the supply of labour at the village level is determined by



factors such as health and nutrition, climate, size of the family, participation in labour force, subsistence needs, presence and accessibility of markets, attitude and educational level, incentives and mobility of labour between farm and non-farm jobs.

**Unemployment and underemployment are the characteristic feature of labour surplus economies like India. Scarcity of seasons of intense farm activities and surplus during slack periods alternating in cycles are commonly met with.**

Determination of wages in any labour market is an interesting phenomenon to study. Generally, the degree of commercialisation in agriculture, customs, traditions, nature and types of crops grown, technological breakthrough and changing values in institutional arrangements strongly influence the quantity and pattern of wage payment. Besides, the two basic forces namely supply and demand for labour determine the wage rate in the market.

Thus, the structure and operation of agricultural labour market, wage determination in the market, migration of labourers and market adjustments in rural areas become important to study. Keeping these issues in view, the present paper aimed to examine the operation of agricultural labour market and the extent to labour migration across production environments.

### Methodology

For the present study, the study region chosen is the North-Western zone of Tamil Nadu. Two blocks were purposively selected to represent two different production environments viz., favourable production environment (Situation I) and unfavourable production environment (Situation II). For the study, irrigation intensity has been taken as a criterion. In each environment 25 farm households, 30 agricultural labour households and 20 non-agricultural labour households were selected randomly and studied.

### Garett's Ranking Technique

In order to rank the various factors responsible for seasonal mobility of labourers across regions, Garett's ranking technique was employed, according to which

$$\text{Per cent position} = \frac{100 (R_{ij} - 0.5)}{N_j}$$

Where,

$R_{ij}$  = rank given for  $i$ th factor by  $j$ th individual

$N_j$  = number of factors ranked by  $j$ th individual

## Results & Discussion

### Operation of Agricultural Labour Market

The labour market is a mechanism for the allocation of labour for the determination of its price; and one may theoretically argue that since labour is being allocated and wages are being paid, the existence of a market can not be denied. Given that a point in time, demand and supply of labour are in equilibrium with a market wage rate, if supply shifts upwards for a given demand, the wage rate is expected to fall and conversely if demand for labour shifts upwards for a given supply the wage rate must go up. This mechanism will operate indefinitely in any economic system if a perfect market exists.

### Supply side

The size of the labour market is found to be quite small at the village level. It could be seen from Table 1 that in Situation I only 39.34 per cent of workers supplied labour against wages in agriculture and 19.43 per cent in non-agricultural sector. In Situation II, 38.27 per cent of workers supplied labour against wages in agriculture and 18.37 per cent in non-agricultural sector. This is not surprising, since the typical holding in agriculture is too small to provide full employment for family workers and many agricultural workers seek non-farm employment on their own account in response to the lack of employment in the crop production sector.

It is seen from the table that most of the agricultural wage labour in the market is supplied by landless agricultural labour households in both the production environments. This is mainly because having no access to land, most of these households are at the bottom of the rural income scale. Their income depends on the rural labour market condition.

It is observed that the proportion of labour supplied by all households to the agriculture is higher in favourable production environments than in unfavourable production environments. Similarly, the labour supplied to the non-agricultural sector is higher in Situation II than in Situation I. Lack of employment throughout the year compels the households to participate in non-agricultural works, which helps to derive additional income for their living. Besides, the low demand for labour in Situation II makes the labour households to move to other places

seasonally, where adequate employment is available. Sometimes they migrate to other places permanently. Thus the supply of labour in unfavourable production environments is significantly affected by seasonal as well as permanent migration.

**Table 1:** Labour supply by type of households

Particulars	% of workers supplying labour in the market		% of labourers supplying labour against wages	
	Agrl.	Non-agrl.	Agrl.	Non-agrl.
<b>Situation I</b>				
Farm households	82.56	17.44	9.30	5.81
Agrl. labour households	84.42	20.78	84.42	10.39
Non-agrl. labour households	20.83	79.17	20.83	58.33
All households	69.19	30.81	39.34	19.43
<b>Situation II</b>				
Farm households	76.40	23.60	13.48	9.00
Agrl. labour households	78.82	35.40	78.32	20.97
Non-agrl. labour households	15.56	84.44	15.56	33.33
All households	66.16	33.84	38.27	18.37

Among the different group of households, as one expects, the non-agricultural labour households supply less labour to the agricultural labour market in both the production environments. The supply from non-agricultural labour households to agricultural labour market is higher (20.83 per cent) in Situation I than in Situation II (15.56 per cent). Non-agricultural labour households, generally supply their labour to the market only during peak seasons, when intense farm activities are carried out. It is observed that the female labourers from these households participate more and attend the tasks of flower picking, cotton kapas picking and transplanting. Though, these households do not get adequate employment through out the year in non-agricultural sector, only a small section is willing to go for agricultural activities because of lack of skills in performing agricultural operations.

**Non-agricultural labour households, generally supply their labour to the market only during peak seasons, when intense farm activities are carried out.**

Besides, there exists an interesting phenomenon of supply of labour to the market. During the peak seasons when demand exceeds supply in the market, the additional supply is made by outside villagers. This additional supply of labour affect the increase in wages due to increase demand and maintain market equilibrium.

From the labour supply function, it is found that family size, per capita consumption expenditure, participation in non-farm and allied activities significantly condition the supply of labour for landless agricultural labour households in both the environments. Similarly, the labour supply for farm households is influenced by size of family workers, number of livestock possessed and presence of permanent labourers (Suresh Kumar and Ramasamy, 1994).

#### **Demand side**

The demand for labour is observed to be spread over throughout the year even though the level varies across production seasons. Percentage of farmers hiring casual, permanent labourers are worked out and presented in Table 2. It is seen that almost all farm households hire labour, including small and marginal farmers. Fluctuations in the demand is mainly due to the seasonality of agricultural production. The demand for agricultural labour on a farm is a function of several factors such as its productivity, wage rate, total acreage under crops, ecological conditions obtaining on the farm, degree of mechanisation, other working expenditures and investments (Agrawal *et al.*, 1970). Though, these factors directly determine the demand for labour, the demand for labour is a derived demand (Kulshreshtha and Uppal, 1979).

The per farm labour demand for crop and livestock activities for different production environments is presented in Table 3. It is seen that the total labour used is (535.94 mandays) higher in favourable production environment than in unfavourable production environment (476.97 mandays). Labour used for crop production is higher in Situation I than in Situation II. Contrarily, labour used for livestock activities is higher in case of unfavourable production environment, implying that diversification of farm activities so as to increase returns.

Labour demand function for the study area is estimated using Unit-Output-Price profit function. The labour demand is significantly influenced by wage rate and size of holding in unfavourable production environments. But the usual inverse relationship between wage rate and labour demand is not observed in favourable production environment. This is due to the fact that given the higher level of demand in Situation I the supply of labour in the market correspondingly increased by enhanced participation of existing households and

**Table 2: Labour Demand by Farm Size**

Size group	Hiring attached labour (%)		Hiring casual labour (%)		Hired labour to total (%)	
	Sitn. I	Sitn. II	Sitn. I	Sitn. II	Sitn.	I
Less than 1.0 hectare	–	–	100.00	100.00	52.94	48.11
1.1 – 2.0 hectares	10.00	16.67	100.00	100.00	52.04	57.64
More than 2.0 hectares	50.00	46.15	100.00	100.00	51.47	64.77
All group	20.00	28.00	100.00	100.00	51.85	61.13

**Table 3: Per farm labour demand for crop and livestock activities**

(Mandays)

Particulars	Family labour	%	Casual labour	%	Permanent labour	%	Total labour
<b>Situation-I</b>							
Crop activity	161.34	73.63	236.08	100.00	57.92	71.75	455.34
Livestock	57.79	26.37	–	–	22.81	28.25	80.60
Crop and livestock	219.13	100.00	236.08	100.00	80.73	100.00	535.94
	(40.89)*		(44.05)		(15.06)		(100.00)
<b>Situation-II</b>							
Crop activity	95.01	66.71	215.34	100.00	74.49	62.48	384.83
Livestock	47.42	33.29	–	–	44.72	37.52	92.14
Crop and livestock	142.43	100.00	215.34	100.00	119.20	100.00	476.97
	(29.86)		(45.15)		(24.99)		(100.00)

\* (Figures in parentheses indicate percentage to total)

labour in-migration. This prevents the increase in wage rate, and consequently the inverse relationship between quantity demanded and wage rate is not observed (Suresh Kumar and Ramasamy, 1994).

### Labour migration

The growing population causes substantial amount of rural to urban migration. Rural to rural migration also take place which mostly occurs during agriculturally slack seasons and is a temporary phenomenon. This affects the operation of labour market in rural areas. The favourable environments and owners of the complementary resources appear to have relatively gained more due to high cropping intensity. Labour seems to move sufficiently freely to these favourable environments and the resulting marginal wage increases do not appear to impose much of a burden on cultivation in such areas. The seasonal and permanent migration of rural households is presented in Table 4.

It is clear that the seasonal and permanent out-migration is more in the case of unfavourable production environments and net in-migration appears to be on the expected line in both the environments. Though

**Table 4: Seasonal and permanent migration of rural labour households**

Particulars	Situation-I	Situation-II
<b>Seasonal</b>		
No. of household in-migrated	55	10
No. of households out-migrated	20	40
Net in-migration <sup>a</sup>	35	-30
<b>Permanent</b>		
No. of households in-migrated	13	5
No. of households out-migrated	5	12
Net in-migration <sup>b</sup>	8	-7

a. The net in-migration is calculated as in-migration minus out-migration and hence interpreted as net in-migration

b. Households who have moved out from the origin and living in the destination for more than 3 years period are considered as permanent migrants. Here the permanent migration refers to a time frame of past 10 years.

both the seasonal and permanent migration is observed in both the environments, both seasonal as well as permanent out-migration is more in Situation II. Thus,

migration enables the labour households to earn their livelihood and thereby labour markets get adjusted.

Seasonal mobility of labour into village and from the village to other areas is an important mechanism of adjustment of labour supply to seasonal changes in the labour demand for agricultural operations. Mobility of labour is governed by 'push' and 'pull' factors like cultural barriers, lack of information about availability of employment, customs and skills.

**Seasonal mobility of labour into and from the village to other areas is an important mechanism of adjustment of labour supply to seasonal changes in the labour demand for agricultural operations.**

**Table 5: Reasons for Mobility**

Particulars	Situation-I	Situation-II
<b>Pull factors</b>		
Higher wages	0.8	4.9
Better non-farm employment	0.4	9.1
Relatives and friends	16.3	15.7
Better farm employment	12.5	0.9
<b>Push factors</b>		
Low wages	45.9	54.6
Inadequate farm employment	34.3	68.3
Indebtedness	-	0.5
Health reasons	0.9	0.7

The push factors are found to exert greater pressure for mobility than the pull factors though in all the cases it is not one single factor, but the resultant effect of the operation of two or more factors are responsible for making final decision on mobility. Among the push factors, inadequate non-farm employment, low wages and inadequate farm employment are the major factors responsible for mobility in Situation I and inadequate farm employment and low wages are the major factors found to cause mobility of labour in Situation II. Among the pull factors, relatives and friends form the major factors responsible for mobility of labour in both the production environments.

Thus it is obvious that the permanent as well as seasonal migration of labour takes place across produc-

tion environments. This ensures equity in terms of income distribution and equalises wages. Migration of labour is seen as an important phenomenon in the adjustment of labour market in a given village or region or across regions.

### Summary & Conclusions

The operation of labour market is found to be quite small at village level and the market structure fairly resembles perfect market conditions in both the situations with relatively large number of buyers and sellers of labour services. It is found that the labour market gets adjusted by permanent as well as seasonal migration. Migration of labour is seen as an important phenomenon in the adjustment of labour market in a given village or region or across villages. The study makes it clear that mobility of labour across villages and regions ensures equity in terms of income distribution and equalises wages. Development of infrastructure would greatly facilitate the mobility of labour from unfavourable production environments to favourable production environments. Policies to supply information on job opportunities in various regions, proper job-counselling, assistance in moving from one area to another are to be strengthened so as to reduce the institutional barriers for inter-regional migration of workers. Participation in non-farm activities provides considerable employment opportunities to the labour households and this in turn reduces surplus labour which is dependent on agriculture. Hence, our human resource development policy should be reoriented to train rural people to participate in non-farm activities. Allied activities such as livestock and sericulture may also be encouraged. The existing demand for labour in unfavourable production environments are not sufficient to cope with the existing labour force. Even though there is out-migration from these villages, it is essential to encourage investment on irrigation reclamation of wastelands and area under forest lands so that labour absorption in rural areas could be increased.

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# Determinants of Acreage Under Sugarcane: A Case Study of Andhra Pradesh

A. Nakula Reddy

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*With a view to testing the risk aversion hypothesis of sugarcane growers, an attempt has been made in the present paper to find out the determinants of sugarcane acreage in Andhra Pradesh. In order to find out the acreage response to price and non-price variables, Nerlove's partial adjustment model has been adopted. For finding out the relative importance of explanatory variables in influencing the acreage under sugarcane, acreage elasticities with respect to different independent variables were estimated. The results clearly indicate that the sugarcane growers in Andhra Pradesh are negatively responding to price risk. The impact of yield risk is relatively low on acreage allocation decision making of farmers. Relative price, Gur price, yield and irrigation variables have favourable influence on farmers' allocation behaviour. In order to encourage farmers to allocate more acreage under sugarcane, price incentives coupled with minimising risk and provision of other non-price incentives are essential.*

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## Introduction

The study of acreage response to price and non-price variables enables policy makers to frame a suitable policy that can contribute favourably to an increase in agricultural output in general and a specific crop output in particular. Whenever there arises the problem of shortage of an essential commodity, the policy maker should think about how to raise the output of that commodity. Hence, the need to search for causal variables which can play a dominant role in influencing the output.

In the present paper, the acreage response of sugarcane in Andhra Pradesh which depends on the technical dynamism of farmers and provision of other basic inputs like fertilizers, pesticides, credit, etc. has been estimated. Sugarcane cultivation requires water for irrigation purpose throughout the year and also the market for easy disposal of cane or 'Gur'. The first requirement i.e., water for irrigation purpose is being provided through assured irrigation source available in different parts of Andhra Pradesh. The second requirement of markets with easy access is being met by factories, cooperative sugar mills and Gur marketing centres.

## Methodology

Three districts, which are predominantly sugarcane growing, (Nizamabad, West Godavari and Chittoor) have been selected to examine the farmers acreage response behaviour. These selected districts accounted for approximately 60 per cent of the area under sugarcane and 65 per cent of cane output in Andhra Pradesh during the study period from 1970-71 to 1994-95. In this study, acreage response has been examined region-wise as well as district-wise using data from Season and Crop Reports published by the Bureau of Economics and Statistics, Government of Andhra Pradesh for the

**Table 1:** District-wise regression results

	Regression Coefficients							
	$P_{t-1}$	$\bar{P}_{t-1}$	$Y_{t-1}$	$I_{t-1}$	PR	YR	$X_{t-1}$	$R^2$
Nizamabad	0.389** (2.189)	0.431* (2.890)	2.190** (1.904)	2.410** (1.889)	-0.189* (3.437)	-	0.491** (1.781)	.73
West Godavari	0.116** (1.919)	0.218** (1.818)	3.160 (1.314)	1.604** (1.417)	-0.128* (3.164)		0.631** (2.401)	.82
Chittoor	0.246** (1.967)	0.334 (0.893)	0.987* (3.876)	2.214* (2.700)	-2.93* (3.081)	-1.306 (1.211)	0.491** (1.909)	.62

Note: \* Significant at 1 per cent level  
 \*\* Significant at 5 per cent level  
 \*\*\* Significant at 10 per cent level  
 (Figures in parentheses are 't' values)

relevant years The relative important of different independent variables including risk aversion hypothesis in influencing sugarcane acreage in Andhra Pradesh has been arrived at and tested. To study the farmers response behaviour to different explanatory variables, Nerloves (1958) partial adjustment model has been adopted.

**The Model**

$$X_t^* = \alpha + \beta_1 P_{t-1} + \beta_2 \bar{P}_{t-1} + \beta_3 Y_{t-1} + \beta_4 I_{t-1} + \beta_5 PR + \beta_6 YR + \beta_7 T + U_t, \text{ where}$$

$$(X_t - X_{t-1}) = B (X_t^* - X_{t-1})$$

$$X_t = B (\alpha + \beta_1 P_{t-1} + \beta_2 \bar{P}_{t-1} + \beta_3 Y_{t-1} + \beta_4 I_{t-1} + \beta_5 PR + \beta_6 YR + \beta_7 T) + X_{t-1} (1-B) + BU_t$$

- $X_t^*$  = Planned acreage under sugarcane in time  $t$
- $X_t$  = Actual acreage under sugarcane in time  $t$
- $X_{t-1}$  = Acreage under cane with one year lag
- $P_{t-1}$  = Relative price of sugarcane with one year lag. (cane price deflated with paddy price)
- $\bar{P}_{t-1}$  = Relative price of Gur with one year lag. (Gur price deflated with paddy price)
- $Y_{t-1}$  = Relative yield of cane
- $I_{t-1}$  = Irrigated area under all crops with one year lag
- PR = Price risk (standard deviation of sugarcane price over five preceding years)

YR = Yield risk (standard deviation of cane yield over five preceding years)

T = Trend variable

$U_t$  = Error term

B = Adjustment coefficient

**Discussion**

The regression results (Table 1) show that in all the selected districts, price risk variable (PR) is negative and significant at 1 per cent level. Since sugarcane is a commercial crop, acreage under this crop is highly responsive to price fluctuations. The farmers in these districts appear to respond negatively to price risk. This implies that farmers have risk aversion behaviour. Yield risk (YR) is also used as an explanatory variable, but it turned out to be not significant. In Nizamabad and West Godavari yield risk has no impact on acreage under sugarcane. In case of Chittoor, however, the yield risk has negative sign, though it is not significant. The relative price of cane has significant positive influence on cane acreage. Relative Gur price is also positive and significant in Nizamabad and West Godavari. This may be due to the presence of Gur marketing centres in these districts. Farmers, after converting cane into Gur, can easily sell the same in these centres. In Chittoor the relative Gur price seems to have no significant influence on the acreage under cane.

Since sugarcane is a commercial crop, acreage under this crop is highly responsive to price fluctuations.

**Table 2:** Regression results—region-wise

	Regression Coefficients							
	$P_{t-1}$	$\bar{P}_{t-1}$	$Y_{t-1}$	$I_{t-1}$	$PR$	$YR$	$X_{t-1}$	$R^2$
Telangana	1.116** (1.916)	0.933** (1.998)	0.824** (1.767)	2.918** (1.871)	-2.466* (2.818)	-	0.523** (2.008)	.64
Andhra	2.440* (2.898)	1.699** (1.963)	2.006** (2.118)	2.601** (1.749)	-4.169* (2.004)	1.096 (1.196)	0.601** (2.212)	.71
Rayalaseema	1.908** (2.498)	0.961 (1.127)	2.817** (2.017)	2.741** (2.108)	-3.491* (3.102)	-	0.586** (2.393)	.68
Andhra Pradesh	2.009** (1.988)	1.861*** (1.696)	2.234** (1.908)	2.664** (2.301)	-2.587** (3.986)	-1.806*** (1.687)	0.542** (1.834)	.74

**Note:** \* Significant at 1 per cent level

\*\* Significant at 5 per cent level

\*\*\* Significant at 10 per cent level

(Figures in parentheses are 't' values)

The influence of relative yield ( $Y_{t-1}$ ) on farmers' responsive behaviour is positive and very strong in Chittoor and relatively low in Nizamabad. Relative yield variable has turned out to be not significant in West Godavari. The effect of irrigation is positive and significant in all three districts. The influence of irrigation on acreage is relatively high in Chittoor compared to other two districts.

The regression results in Table 2 show that price risk variable is negative and statistically significant at 1 per cent level in all three regions as well as for Andhra Pradesh as a whole. This reveals the fact that sugarcane farmers in the state as a whole are negatively responding to price risk variable while allocating area to sugarcane cultivation. These results support the risk aversion hypothesis of farmers. Further, yield risk does not seem to have any impact on farmers acreage allocative behaviour in respect of all the three regions. In case of Andhra Pradesh as a Unit, it has some influence (though relatively low and significant only at 10 per cent level) on farmers response behaviour. This might be due to inter-regional differences which persist in different respects among the three regions.

**Sugarcane farmers in the state as a whole are negatively responding to price risk variable while allocating area to sugarcane cultivation.**

The coefficient for relative price of cane ( $P_{t-1}$ ) is both positive and statistically significant in all the three regions and Andhra Pradesh. The coefficient of Gur Price ( $\bar{P}_{t-1}$ ) is also positive and significant except for Rayalaseema region. For Andhra Pradesh as a whole it is significant at 10 per cent level. One possible reason for this is that Gur production involves risk and market uncertainty for its disposal. Hence, a majority of farmers dispose off their cane at factories rather than to retain and produce jaggary themselves. So the Gur price has relatively low impact compared to cane price on acreage under sugarcane. Yield (YR) and irrigation ( $I_{t-1}$ ) variables positively and significantly influencing acreage under sugarcane.

### Elasticities

Acreage elasticities for the three districts have been calculated for all variables which have turned out to be statistically significant in regression equations. The short-run and long-run elasticities\* have been estimated.

\* Acreage elasticities have been estimated for price and non-price variables like  $Y_{t-1}$ ,  $I_{t-1}$ , and YR to show the relative importance of these variables in influencing the farmers allocative behaviour. An effort has been made to estimate both short run and long run elasticities using the following formulae:

$$\text{Short-run price elasticity of Acreage} = \frac{\text{Mean value of the independent variable}}{\text{Mean value of the dependent variable}} \times \text{Coefficient of price variable}$$

$$\text{Long-run elasticity} = \frac{\text{short run elasticity}}{\text{Adjustment Coefficient (B Value)}}$$

**Table 3:** District-wise acreage elasticities

1	$P_{t-1}$		$\bar{P}_{t-1}$		$Y_{t-1}$		$I_{t-1}$		PR		YR		B value
	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR	
	2	3	4	5	6	7	8	9	10	11	12	13	14
Nizamabad	.11	.21	.26	.51	.08	.15	.12	.23	.39	.76	-	-	.51
West Godavari	.07	.19	.13	.35	.09	.24	.06	.16	.16	.43	-	-	.37
Chittoor	.14	.23	-	-	.27	.44	.17	.28	.34	.56	.04	.06	.61

**Table 4:** Region-wise acreage elasticities

1	$P_{t-1}$		$\bar{P}_{t-1}$		$Y_{t-1}$		$I_{t-1}$		PR		YR		B value
	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR	SR	LR	
	2	3	4	5	6	7	8	9	10	11	12	13	14
Telangana	.22	.46	.14	.29	.16	.33	.10	.21	.26	.54	-	-	.48
Andhra	.17	.42	.05	.12	.08	.20	.09	.23	.23	.57	-	-	.40
Rayalaseema	.12	.28	-	-	.13	.31	.15	.35	.18	.39	-	-	.42
Andhra Pradesh	.15	.32	.13	.28	.08	.17	.12	.26	.32	.45	.06	.13	.61

Table 3 shows that the elasticity of price risk variable is much higher than elasticities of other variables in all the three districts. This variable alone accounts for major proportion of decline in acreage under sugarcane. With respect to other elasticities one can notice inter-district differences. In case of Nizamabad and West Godavari relative Gur price elasticity accounts for a major proportion of change in acreage, whereas in Chittoor relative yield has a major influence on acreage.

As per the findings incorporated in Table 4, the short run and long run price risk elasticities are higher than short run and long run elasticities respectively of relative price, relative Gur price, relative yield and irrigation in the three regions and Andhra Pradesh as a whole. The long run elasticity of price risk variable is found to be ranging between 0.39 and 0.57. Even here, farmers have relatively higher elasticity with respect to price risk compared their counterparts in other regions and Andhra Pradesh. The relatively low magnitude of yield risk elas-

ticity indicates its insignificant influence on acreage. For the state as a whole, the relative price elasticity accounts for major change in acreage.

### Conclusions

This study tests farmers' risk aversion hypothesis. The farmers in Andhra Pradesh are negatively responding to price risk. The coefficient for the price risk variable is negative and significant for all the three districts of our sample, for all the three regions and for the entire state at 1 per cent level. Thus, the results obtained in the present paper lend support to the risk aversion hypothesis regarding the behaviour of sugarcane growers. The impact of yield risk is relatively low on acreage allocation decision making of farmers. Relative price, Gur price, yield and irrigation variables have favourable influence on farmers response behaviour, since the coefficients of these variables are not only positive but also are significant at different levels of confidence intervals among three regions and Andhra Pradesh as a whole. In order to attain sugarcane output targets, price and non-price incentives as well as measures for minimising farmers' risk are essential.

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**The short run and long run price risk elasticities are higher than short run and long run elasticities respectively of relative price, relative Gur price, relative yield and irrigation among three regions and Andhra Pradesh as a whole.**



# Book Reviews

**Economics of Collaboration—Indian Shoe Makers Between Market and Hierarchy** by *Peter Knorringa*, Sage Publications, New Delhi, 1996, Price Rs. 295.

The book which is the result of the study carried out by the author, is a publication of the Faculty of Environmental Studies, University of Amsterdam, The Netherlands under its series on the theme of 'Livelihood and Environment'.

The study pertains to the footwear industry of Agra generally known for its Taj Mahal. Agra is the top footwear producer in India and is well known for its capability in the area. What is not so well known is the fact that footwear production in Agra is built around a typical marketing and manufacturing system which depends, to a very large extent, on the socio-economic relationship between the workers and the entrepreneurs. The book attempts to highlight and focus on their traditional pattern of trading relationship—something very specific to Agra.

The underlying study started in early nineties with data collection on 'Impact of Technological and Organisational Changes on Women's Employment in the Leather Footwear Industry in India'. Later under a grant provided by WOTRO—Netherlands Foundation for Advancement of Tropical Research, the author supplemented the data collected earlier in the later half of 1992-93. The author received active support and assistance from Central Leather Research Institute, Madras, which initiated him into the mystery of Agra's domination of footwear manufacture and market in India.

Footwear manufacture in Agra, and even elsewhere, is a labour intensive, caste based occupation. These two factors are largely responsible for the gradual evolution of the kind of structure that has become Agra's peculiarity. It is this peculiarity which has led to so many socio-economic studies of Agra's footwear industry. Knorringa's study, the basis of the book, is another attempt in the direction with the exception that it has focused on exploring and highlighting producer-trade relationship in

Agra's footwear cluster. In the process, the author has also successfully investigated and analysed such subjects as employment opportunities, the role of market agents, the method of executing bargaining between different market operators and workers, stability of income and the exploitative conditions to which the footwear worker is exposed. The author visited all other main footwear centres in India and finally settled on Agra as it happens to be India's most important and diversified footwear cluster, according to him.

The author, despite the support he was able to garner from CLRI and other authorities, did face difficulties in obtaining reasonably accurate information and data particularly in such areas as profits, spending habits, relationships and the practices followed by the market agents and neophyte entrepreneurs. Being a foreigner, possessing little or no knowledge of the local language, the author depended on paid translators for interpreting the views of different players and operators in the area of footwear manufacture. This may have affected the correct understanding of the communication and the nuances of the relationships described through interpreters, as the latter's prejudices and opinions of the prevailing situation could not have been totally avoided.

Bulk of Agra's footwear output is the handiwork of the typical dalit workers—locally known as Jatavs, most of whom even today have no more than a hand-to-mouth existence and for which too they have to look up to the munificence and benevolence of the market operators who provide them advances, designs and generally help them and their families to survive. The author does not make any reference to the Govt. efforts, successful or otherwise, to improve the lot of this class on whom rests Agra's pre-eminence in the footwear realm.

The book has seven chapters. It begins with an introduction in Chapter 1 and gives a brief account of the methodology followed in Chapter 2 and also explains the objectives and the survey questionnaire, details of which are given in the appendix. The method of data collection and the problems and the difficulties ex-

perienced in collecting data and information from the sample respondents and the limitations of the study are also explained.

The main analysis and interpretation of the data obtained is contained in Chapters 4 and 6 which also bring out the flavour of the study i.e., the kind of relationship that has developed between different players in the footwear industry of Agra. Chapter 5 gives an overview of Agra's footwear industry and goes on to describe, what the author considers as, Agra's footwear clusters and how these differ from the standard clustering that exists in a country like Italy. Chapter 3 describes the economic relationships between small scale entrepreneurs and market agents, a peculiar institution that the higher caste money bags sustain solely for their own benefit by exploiting the deprived category of manual workers often possessing skills but no finance. Chapter 7 presents useful information on the present and future employment opportunities and conditions in Agra's footwear industry and its three main segments—sweat-shops, small sector units and the organised enterprises run by local entrepreneurs often hopefully looking for overnight prosperity. This chapter should provide enough food for thought to the planners concerned with the so called poverty elimination strategies. For those short on time, Chapter 8 provides a fairly good summary of the foregoing chapters and also contains some of the important conclusions drawn by the author.

The book has a good get up. It is well printed and without any major printing errors or spelling mistakes. The editing, has been done quite satisfactorily, which is usually not the case with many such publications. The book is priced reasonably at Rs. 295 a piece. It also provides a detailed bibliography which should be useful to any future research into footwear industry here or elsewhere.

The book is well conceived but its objective of providing material for policy makers and planners may remain unrealized unless the sponsors of the study actively pursue the examination, review and adoption of its recommendations by the Indian authorities both at political and administrative level.

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**Preparing the Work Force for 21st Century Asian Productivity Organisation, Tokyo, (Japan) 1997, p. 353.**

This book presents a kaleidoscopic picture of dif-

ferent facets of preparing the workforce in the Asian and other developing countries for the 21st century. The global and regional trends, business environment and the needs of workforce for organisational and Human Resources Development (HRD) by the year 2000 have been pointed out.

Revolutions in biotechnology, production and distribution systems, electronics information, data systems and globally geared Research and Development will perhaps drastically change lifestyles of the workforce in the 21st century. The critical issues faced by most Asian and other developing countries today have been highlighted in the volume and suggestions have been made as to how to manage this change. So the workforce whether it is white or blue collar, will tilt the trade balance of not only the developing countries but also of the developed countries against each other in terms of competitive advantage.

The articles in this book will enlighten the business leaders in the developing countries while globalising their industries to meet any challenge, including domestic, by ensuring that they and their workforce keep abreast of the fast changing technologies, market and mindset of the work culture of the organisations.

The resource papers and country papers recognise the significant impact of fast changing technological and economic environment on the policies and operational framework of HRD and also explored the existence of mismatch between the demand for and supply of skills and suggest various recommendations for the future best workforce.

This book is bound to attract a good deal of attention among all industrial planners, corporate administrators, management researchers, teacher educators and nation builders and those who are interested in developing the workforce in 21st century.

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**Beyond the Uruguay Round – The Indian Perspective on GATT by Bibek Debroy, Response Books, Sage Publications, New Delhi, 1996, p. 225, Rs. 325.**

The Uruguay Round in general and the Dunkel draft in particular became highly controversial in many developing countries including India. Discussions and

debates on the pros and cons of the agreement started all around the country involving a variety of groups starting from the intelligentsia to the common men on the street. The opponents termed it as a compromise on the sovereignty of the country. The supporters, on the other hand, saw it as an opportunity for India to improve its position in the international trade front. The arguments and counter arguments on the subject, however, could not clear the confusion that was hovering around the minds of many.

The book under review tries to answer whether Uruguay Round is beneficial or not by putting across a balanced view on the subject. As the title suggests the book looks beyond the Uruguay Round and it is an Indian perspective on GATT. The author terms GATT as a *fait accompli* for India. Opting out of GATT is not very difficult. Only a notice of six months is all what is required for this. But then, such withdrawal is not costless. So it is not worth, the author suggests, to get bogged down in the debates on the pros and cons of the agreement. It is better to look forward on what the new agreement offers to India. The book in its well knitted eleven chapters attempts to present an elaborate discussion on this.

Quite naturally, after a brief introduction on the subject, the first chapter of the book presents the detailed background against which the Uruguay Round negotiations took place. The developments on international trade are described from the days of Bretton Woods to the Tokyo Round of the GATT, a period depicting a shift from bilateralism to multilateralism in world trade. Chapter 2 gives an overview of the Uruguay Round accord and the remaining nine chapters get into the nitty-gritties of individual agreements.

GATT's primary objective was to remove barriers to world trade. The barriers include both Tariffs such as import duties and Non Tariff Barriers (NTBs) like quotas. The Tariffs and NTBs for sectors other than agriculture, textile and clothing are discussed in detail in chapter 3. It is stated that India needs to introduce further reforms in the domestic economy to reap the full advantages from GATT. The Uruguay Round proposes gradual phasing out of quotas imposed under the multi fibre arrangements (MFA). This is certainly one area where Indian exporters of textiles and garments are likely to gain. However, the removal of quotas does not guarantee increased market share as competition also heats up with the liberalisation. After a SWOT analysis of the Indian textile and garment sectors, Debroy concludes that the implication of the GATT agreement is greater competition and if India has to emerge a gainer it has to be an efficient producer of such commodities.

The agreement on agriculture evoked widespread

criticism against GATT in India. It was alleged that the Uruguay Round agreement is against the interests of the farmers as the subsidies given to them by the government will have to be withdrawn because of GATT compliance. 'The farmers will also not be able to save seeds from their produce' and 'the public distribution system (PDS) will cease to operate in the country' were two other issues getting prominence in the debate. The book devotes an entire chapter to discuss such issues and it terms the fear of subsidy withdrawal etc. as a 'myth' rather than a 'reality'.

Perhaps more controversial was the issue of patenting and its impact on drug prices in India. The general impression was that the GATT will bring in drastic increase in prices of drugs. The author also admits that with the introduction of product patents, drug prices are bound to go up in the country. But the GATT will be having some positive side effects on Indian pharmaceutical sector. Better patent protection will ensure the entry of newly developed drugs which, so far, were either not marketed in India for fear of piracy or introduced after a substantial time gap from their arrival in the international market. The patenting will also have little impact on the prices of essential drugs as the terms of protection for such drugs have already expired or are going to expire in the near future.

The book has separate chapters on Trade Related Investment Measures (TRIMS) and Trade Related Intellectual Properties (TRIPS), the areas for the first time brought under the purview of GATT in the Uruguay Round. Another new area *services* is discussed at length in Chapter 7. Towards the end, the book explains the rules of GATT and some remaining agreements and other issues including environmental issues and labour standards. As a whole the book gives a clear understanding of the Uruguay Round Agreements and their likely impact on India. What strikes most are its lucid language and reader friendly manner. A variety of readers including the businessmen, policy makers and students of international trade may find it interesting. Lastly, even though the book presents a balanced view on the subject, the underlying tone is favouring GATT causes. Of course, the author is honest enough to confess.

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**Prospective Agricultural Technologies in Asia and the Pacific by M.A. Choudhary (Ed.), Asian Productivity Organisation, Tokyo, Japan, 1997, p. 420.**

Technology has been the driving force behind the modern agricultural growth everywhere. The book

under review is a collection of resource papers and country papers on various aspects of agricultural technology, especially its prospects and future role in agricultural development in the Asia-Pacific region, presented in a study meeting held in Tokyo from July 25 to August 4, 1995. Brought out in the form of a report, the book is, in fact, a very well edited volume by one of the resource persons (Dr. M.A. Choudhary).

All the resource papers are in the nature of a general global view of the present state of agricultural development with focus on sustainability of both technology as well as the growth momentum in agriculture. The major technology areas covered in different papers include rice production technology, fertiliser technology, biotechnology and computerisation, green revolution technology, and general mechanisation of production processes in agriculture. One of the major concerns of the papers from the context of Japan is the adverse environmental and human impact of agricultural technologies and wastage of input resources, resulting in loss of overall human and other welfare. However, it is argued that biotechnology is not in conflict with nature as it is itself nature-based in its learning. The potential biotechnology areas are identified.

Another aspect of technology progress in countries like Japan which is crucial to cut cost and improve efficiency is mechanisation of operations, including the use of robots, which is being developed in Japan on a priority basis. Some of the commonly known practices suggested, but not yet adopted on a large scale by farmers, are; use of organic matter, crop rotation, and minimum tillage. The more advanced technologies include non-pesticidal control of diseases and insects, sex-pheromone, and soil amendment.

It is argued that the sustainability of agricultural technology should also ensure that the socio-economic implications of the technology are not adverse. For example, in GR technology, there could have been aggravation of income inequality, and malnutrition problems, due to the differential levels of adoption of technology across different regions and classes of farmers, if suitable public policy measures were not in place. Already, the environmental degradation brought about by GR is too well known in developing countries to merit any specific mention here.

The country papers reveal that under the new economic environment, agriculture is increasingly under resource constraint due to the withdrawal of subsidies on various inputs. But the problems plaguing agricultural technology development are: lack of capital resources with farmers, mal-availability of inputs, and environmental calamities like floods, droughts, cyclones, etc. The ques-

tions of environmental protection and sustainable development need to direct the new agricultural technology development in these countries.

In some of the small countries like Hong Kong and Malaysia, declining farming population is a cause for concern. On the other hand, countries like India, Korea, and Mongolia are emphasising value added processing of commodities in order to make farming a viable activity. Sri Lanka, Nepal, and the Philippines face problems of inadequate and costly transfer of technology to the farmers which has hampered agricultural growth process. Since these countries differ significantly in their size of agricultural sectors and the levels of their growth and development, they are in need of differential strategies for technology development. But, the overriding concern everywhere is in the protection and conservation of natural resource base which is so crucial for agricultural development as well as overall human existence and welfare.

The major recommendations of the book are both general in nature as well as specific to sub-sectors of agriculture. At the very general level, since technology is to serve the overall developmental needs, it has to be embedded within the sustainable development framework which promotes equity and ecological balance. For this to happen, environmental accounting is suggested as a crucial first step. Further, multi-disciplinary, demand driven, and participatory (involving farmers) research in technology should be undertaken.

Among the specific suggestions are: seed technology (HYV) development for dry lands, coarse grains, and vegetables; use of better information through GIS and Remote Sensing for integrated planning; more efficient use of scarce resources and technologies; better energy management; value addition by processing; and better development and management of infrastructure including institutional, for farmer participation and betterment. On the whole, the book brings together the status of agricultural technologies across the countries of the Asia-Pacific and opens up vistas for mutual exchange of technological information and more co-ordinated technological development and management. But, there are quite a few papers in which some letters from the titles are missing, perhaps due to (industrial?) technology failure!

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**Anti Dumping and Countervailing Measures: The Complete Reference by R.R. Gupta, Response Books, Sage Publications, New Delhi. 1996, p. 298, Rs. 425.**

In the last decade the most controversial subject has been the 8th Round of GATT. The controversy did not confine to the academic and economic policy makers but also entered in the political and social spheres. Although the Uruguay Round concluded by end of 1993 and became operational in 1995, new controversies have also cropped up. The world based on the principle of free global trade is yet a distant dream.

The present book under review is divided into 11 chapters. The author deserves to be complimented, for this is the first study of its kind which has been brought up in the post GATT period, relating to the anti-dumping and countervailing measures. A large number of countries have been involved in dumping practices through different means, which can threaten the very basis of World Trade Organisation.

The first chapter deals with the background and mechanism of countervailing measures under the new charter of WTO. Legal provisions, dealing with the role of domestic industry, importer, exporter concerned Govts. and the WTO have been elaborated. Under para 2.1 of article 2 of the agreement on implementation of article VI of the GATT 1994 provides that a product is to be considered as being dumped if its export price is less than the aggregate domestic price. Concepts of weighted average export price and weighted average normal value of dumped goods and other necessary pre-requisites have been elaborated in Chapter II.

It has been substantiated that dumping harms the domestic industry of importing nation in many ways that are well documented. The legal framework of the anti-dumping agreement has taken into its purview all aspects of the harm done to domestic industry. Obviously it is the responsibility of the importing country to probe dumping under the above legal frame work.

Each member country of WTO has created its own mechanism for investigating the alleged dumping of imports. In case authorities are convinced, then they may initiate the necessary protective measures in form of duties etc. There is a detailed mechanism for dealing with the subsidies which have been covered under the anti dumping laws. All these aspects are discussed in the book.

In Chapter 8 of the book, mechanism of countervailing measures in US, EC and India have been elaborated. The countervailing duties can be imposed in

case it is found that the exports has been subsidised. However, special concessional treatment has been given to the developing countries in case of subsidies. In India, Customs, Excise and Gold (control) Appellate Tribunal constituted under section 129 of the Customs Act 1962 looks into the matters of appellate remedies against the decisions of the investigating authorities in India. Director General of WTO also sometimes plays a role of conciliation and mediation so as to settle the disputes. The case studies cited in the book have not only further enhanced the value of academic input of the book but are also quite useful in understanding the applied side of the post GATT period.

Though the book can be considered as a maiden work in this field, the author has failed to highlight the inherent structural weaknesses of WTO. The whole mechanism has been designed to favour the few developed countries at the cost of large number of developing countries. In the absence of level playing field, the developing countries are at receiving end in the entire WTO frame work for anti dumping and countervailing measures. The approach based on pure empiricism is going to have its own limitations.

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**Management of Systems by A.K. Gupta and J.K. Sharma, Macmillan (India) Ltd., New Delhi, 1997, p. 559, Rs. 220.**

The book has addressed to various important topics in the broad field of management. It is divided into 13 chapters: management planning and control; human resource planning and management; organisation planning, design and development; production resources, planning and control; product design and development; material planning and control; maintenance and systems reliability; total quality management; marketing management; financial management; managerial economics; project management and management information system. The organisation of the chapters is, by and large, good.

The book essentially covers the topics of Industrial Management and General Management. In the present form it is descriptive and its presentation reflects its orientation for the students in the field of commerce/arts. It would have been more appropriate to use *systems concept* more meaningfully, as the title of the

book is expected to convey. This would have raised the utility of the book for engineering/technical students.

Nevertheless, the book is very well written with several solved examples and unsolved questions. It is quite readable. The book can serve the needs of students pursuing the related subjects through correspondence courses. It does fulfil such a need in a very nice and effective way.

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**The QC Problem Solving Approach—solving workplace problems the Japanese way by Katsuya Hosotani, Productivity Press India Pvt. Ltd. Madras, 1996, p. 168, Rs. 295.**

The harsh business environment today abounds in work-place leaders entrusted with (possibly) commensurate responsibility and authority for achieving organisational objectives. It is their competence that defines the degree of success each business is capable of achieving. The true strength of their work-place resides in the problem-solving attitude that they inculcate amongst their fellow-personnel, and therein lies the essence of TQC. The QC problem-solving approach, as espoused by Katsuya Hosotani, addresses this vital TQC ingredient (i.e. solving problems rationally, scientifically, efficiently and effectively using the "QC view-point", the "QC problem-solving formula" and the "QC tools").

Here, the "problem" is the gap between the existing situation and the desired objective, and can be solved either through the deductive approach of using the fundamental sciences, or the inductive approach preferred by QCs for its suitability to work-place problems. The "QC view-point" puts in perspective, the organisational culture essential for nurturing this problem-solving approach. Such an environment has to be conducive for according priority to improving quality rather than merely improving the bottom-line. It has to foster a positive orientation towards external and internal customers, in both cases, the emphasis being on ensuring the return of the customer, and not the product. It has to promote management by facts (data) and impart to its personnel, the ability to differentiate the "significant-few" problems from the "trivial-many", and accordingly allocate priorities. While the "QC view-point" advocated the PDCA cycle to be the pre-dominant influence in realising solutions, it encourages the appropriate application of poka-yoke, JIT, process control, dispersion control,

recurrence prevention and standardisation, as a means of initiating work-place improvements.

The second of the three keys to solving problems the QC way is the 7-step formula. This fundamental stratagem is a glorified version of the PDCA cycle and the traditional IE methodology (Select, Record, Evaluate, Develop, Implement & Maintain). While Hosotani recommends that the basic sequence of this 7-step formula be broadly adhered to, he also offers the option of customising it, to suit the nature of problem being tackled. The highlight of this section is the brief, yet relevant treatment of the "Develop Solution" stage, that broaches knowledge-pooling techniques like the idea-generation strategy and the checklist method. Also, the 4M technique, 5W1H technique and the WUS (Waste, Unevenness & Strain) technique, excellently illustrates the utility of the checklist method.

The final step in the QC problem approach—the QC tools—has not found much mention in this book, presumably due to the abundance of supplementary reading available on this topic. However, the various cases described therein, ought to make up for this deficiency. Hosotani, besides referring to the traditional old and new QC tools, goads the reader to use various statistical methods, and other peripheral methods like IE, VE, OR etc. The usage of the tools vis-à-vis the various stages of the problem-solving process, also, has been described in detail.

Overall, this book makes a structured reading for both beginners and TQM professionals alike. The relevance and blend of the case studies with the main context deserve to be lauded. But for the voluminous works presently available on this subject, this book would have certainly drawn the attention of managers in their elusive quest of TQM. One can only hope that there still are practitioners who can put this book to good use.

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**Industrialisation, Socio-Economic Externalities and State Policy by Abdul Aziz (Ed.), Concept Publishing Company, New Delhi, 1997, p. 241, Price not mentioned.**

The present book is the outcome of a national seminar held at the Institute of Social and Economic Change, Bangalore during the month of August 1996,

The unique feature of the book is an interaction between the three vital components of development namely: industrialisation, socio-economic externalities and the role and contribution of the state in the promotion socio-economic development in the State of Karnataka in general and Bellary district in particular.

The book contains 18 original essays on the subject based on field survey conducted and hence the observations and conclusions are original in nature and character. A noteworthy feature of the book is the discussion of the issues with three vital segments of Bellary district namely—officers, industrialists and citizens of the district so that proper interaction could be possible which would be more worthwhile for the policy makers in formulating the industrial strategy of the district.

Firstly, the essay of Seshadri and Jayanna needs some reviewing. The authors have given a synoptic view of some of the vital components of the economy of Bellary district where on a discussion is made with regard to physiographic, demographic, administrative and socio-economic facets. It is observed that "present structure of the district economy reveals the dominance of the primary sector. The composite index of development, per capita income and all the indicators of physical quality of life are of moderate nature". This means Bellary district has not made much headway in respect of industrial development.

Another paper authored by Aziz and Babu provides a systematic account of growth pattern of one of the most vital needs for growth and development i.e., availability of physical infrastructure which has not witnessed any appreciable growth and development. The paper stresses the proper interaction between the Government and the industrialists.

The paper of Vasuki entitled 'Industrialisation and Ecological Disaster' stresses that industrialisation should take place without creating ecological imbalances. Preservation of bio-diversity is sine-qua-non for real growth and development of the district. The author has also given some guide-posts for preventing further ecological degradation. The paper suggests that there should be an effective and meaningful interaction between the Government, local people and NGOs for maintaining proper ecological balance.

The paper authored by Krishna gives an excellent account of the role of panchayatiraj in the growth and development of Bellary district of Karnataka. Bellary district has had an appreciable growth and development, through panchayatiraj institutions. The development comprises road network, water supply, housing development and generating desired awareness among

the people. It is recommended that the planning of the various programmes and schemes by the panchayats should aim at synchronising the same with the schemes of the state sector, industries and contribution from other non-governmental efforts.

Another interesting paper entitled "Role of industrialists: private enterprises with a social perspective" is thought provoking and gives a new dimension of social transformation of Bellary district. The paper gives much emphasis on mega projects to make a real contribution in solving the developmental problems of the local area. It also stresses that this process should go on without losing focus of mega projects of the principal functions of producing hi-tech goods and services for the national and global economy which is the missing link. There is a need that the responsibility should be placed on industrialists to help the communities in their respective areas in adjusting to the radically changed pattern of life.

On the whole the book is a welcome addition in the existing literature on the vital subject of growth and development. It would serve a good cause for those who are related with the area.

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**TQM in the Construction Industry: Maeda Corporation by Matabee Kenji Maeda and Yasuji Maeda, Asian Productivity Organisation, Tokyo, 1997, p. 115, unpriced.**

Construction is a very important industrial activity in most transforming economies of Asia. Management of construction projects deserves specific management strategies to tackle issues of quality, delivery, customer service, cost and time. Management of total quality has therefore assumed greater significance in construction industry more so because of 'cross functional' management activities and 'flexible relationship' amongst customers, architects, construction company and sub-contractors.

Maeda Corporation, founded in 1919 in Japan, has been a pioneer in construction of electric power plants and dams has got universal acclaim through national and international awards, the most significant one being the Deming Prize in 1989. It has got an impressive list of clientele, with sales of 529.9 billion yens in 1995. Besides a chain of 51 sales and marketing offices in Japan (12 abroad), it has 800 collaborative work sites in Japan. So, implementing total quality, could well be a herculean task.

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This book authored by Chairman and President of Maeda Corporation, gives a first hand account of how Maeda Corporation undertook the development journey to Total Quality Management (TQM) and Deming Prize (an important milestone) right from the year 1980.

Maeda Corporation's companywide quality policy focuses on doing high quality work. It correctly points out towards unique quality assurance challenges in construction industry as compared to line/continuous production. M. Maeda has given a systematic course of how TQM was implemented with focus on reforming the corporation. The Presidential policy in 1985 focused on promoting TQM to solve the then existing difficulties, aiming towards permanent growth while in 1989 it focused on making a companywide effect to improve the corporate character with emphasis on safety and quality and aim to win the Deming Prize and improve business performance. Maeda's priority issues, just before getting the Deming Prize in 1989 were:

- Informing customers of quality assurance strategy and implementing it.
- Transforming the company into one that actively promotes its own ideas and business development.
- Taking specific measures to secure and nurture capable sub-contractors.

M. Maeda also talks about a very important strategy to tackle—TQM problems—the 'top management diagnosis'. In particular carrying out an extensive three year diagnostic exercise before the company got Deming Prize. Primarily, the focus of diagnosis as a part of which presentations were made by the 'diagnosed parties' to 'diagnosing parties' had been to clarify the goals and points that should have been improved by grasping the overall status and level of progress of TQM activities.

In fact, daily management has been cited by Matabee Maeda as an important element in managing control points. He rightly points out that though following daily management refers to maintaining 'status quo', it also includes activities that aim at improvement in overall operations. So, the importance of 'status quo' particularly in production companies cannot be sidelined as the basic principle of 'status quo' is to comply with standards and norms and which is important from control and improvement point of view. He further focuses on safety management at the company and its partners. In fact, for construction projects, safety education, safety control and management have been crucially analysed through a network of 'Danger Prediction Activities' using accident analysis and so on.

Yasuji Maeda, the President of Maeda Corporation in part II of the book, outlines major post-Deming award activities. Most of these are focused on:

- Building information system integrating purchasing, sales and financial accounting functions as a part of Chain Integrated System.
- Developing improved technologies
- Building strategic business alliances amongst partners.
- Environmental conservation, and
- Groupwide quality control activities.

In the end, Y. Maeda introduces the reader to 'Vision Maeda 2001' envisaging a continual TQM approach so that Maeda shines like a 'Morning Star' in the 'Land of Rising Sun'.

I am not sure whether Japanese read 'Corporation' as 'Cooperation' as spelt on p. 2. In any case, the book would serve to be a useful reading for corporate professionals, especially from architectural and civil engineering firms as it has, no doubt, given an interesting account of TQM implementation in one of the world's most successful Corporations. The effort of APO, Tokyo in this direction is praiseworthy.

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**Drucker on Asia by Peter Drucker and Isao Nakauchi, Butterworth Heinemann, 1997, p. 192, Rs. 495.**

The legendary classic *Bhagavat Gita* viz., a dialogue between Lord Krishna and Arjuna at the Mahabharat battlefield, has served as the reference for revealing the science and secrets of many facets of human life. On a smaller scale, the present book can be compared to the *Gita* as it contains the dialogue between Peter Drucker, the management guru and Isao Nakauchi, a Japanese entrepreneur. This book has also come at the time of intense difficulties faced by the Asian economies in their path towards growth and progress.

This book has an astonishing resemblance to the *Gita* with Nakauchi doing the role of Arjuna asking questions about various management aspects that can make Japan come out of the 'bursting of the bubble economy' it finds itself in. Nakauchi rightly worries about the



changing perceptions on the roles of the Government, the New Technology, the Business, the Executive, the Individual etc., to transform and create the 'Third Economic Revolution' of Japan and through it benefiting the whole International Community. Peter Drucker in his characteristic style answers the questions drawing out examples from his vast pool of knowledge and experience. His explanations reinforce that business has to constantly look and prepare itself for change while maintaining stability at the same time. Very lucid explanations as to how the education system should change to meet the challenges of modern information revolution, what are the responsibilities of business enterprises in the new dispensations, how the individual can excel in practice towards perfection and how the Governments and nation states have to take up new global roles while removing the conventional and outdated regulations are some of the highlights of the book.

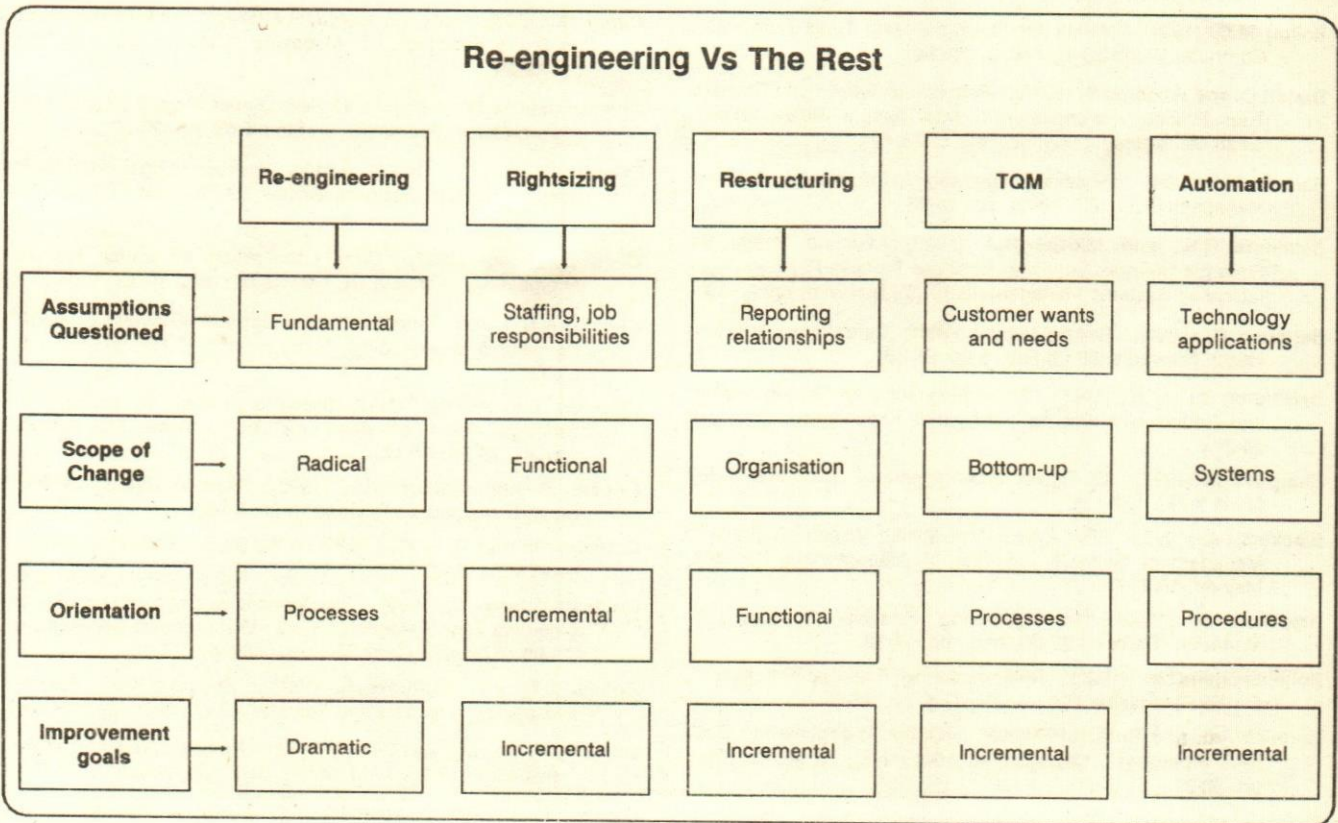
Though the book is titled 'On Asia', which is possibly because of the discussions centering around happenings in Japan and the lessons it can learn from the West, the contents of the book is relevant to Management expectations of all regions. Some of the examples given

by Drucker and Nakauchi remind of strikingly similar events in developing countries like India.

Like *Gita*, Drucker does not specify any single solution for the problems posed but brings out the past, present and future ramifications of various management and technology changes and kindles imaginations in the minds of the reader. His own autobiography presented shortly in the book gives insight into the practice of simple disciplined methods that can make all the difference between the ordinary and the celebrated.

The book is a must for management learners who are looking for the broader canvas on which the solutions for the problems posed by the fast changes that are taking place in the society and the workplace, have to be identified.

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# Select Bibliography on Business Process Re-engineering

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